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Out of a Hogshead.

TO the owner of a microscope, be it never so cheap or small, a meadow brook, a lowland ditch, or even the little pool in a cow's hoof-print, is an attraction and a source of microscopic wealth; but as an irrestible temptation, as a bonanza of inexhaustable study, a weedy mill-pond in a woody hollow surpasses everything. I recently found such a mill-pond, and for *myriophyllum, utricularia, ceratophyllum*, microscopic algæ and infusoria, it could not be excelled. A leaky boat and a pole made the writer happy until he found his bottle was missing; that single drop of bitterness embittered the whole pond, for what could be done without a bottle, and the microscope ten miles away? The only relic of civilization within reach was an old envelope, so into that paper bag greedy fingers stuffed the aquatic plants that the pole brought from the cool and weedy depths. *Utricularia inflata* revelled in abundance, and bloomed the pond over; *myriophyllum* was weighed down by a cloudy mass of microscopic treasures, while winding about and entangling itself everywhere were quantities of a small and delicate fruiting *chara* which I had no means of determining.

At home the plants were separated and placed in hydrant water, the *chara* going into a glass saucer which turned out to be a stepping stone, so to speak, up to the hogshead at the top of this page. After the study of the circulatory movements of the cell contents, a motion in this case taking a course resembling an elongated figure of eight, and of the wonderful fruit in which the cyclosis was also visible, the plants were neglected. Now it happens that whenever the ladies of the household visit my particular room, especially after a microscopic tour among the ditches, they hesitate at the threshold, peer in and sniff. In this instance, however, I noticed that my uninvited guests entered boldly and sat down without saying "phew!" An occurrence so rare demanded investigation. The *utricularia* and the *myriophyllum* in one vessel were evidently dead, but instead of forming a slimy, putrefying, evil-smelling mass, as usual, the utricles and leaves had fallen, the stems had almost entirely preserved their integrity, while the *chara*, although dead, had not gone to pieces, nor had the fruit left its place. What was the matter? Memory said that no water, except what may have adhered to the plants, had been brought from the pond, and none had been added except that from the hydrant, and never before had it exhibited such preservative qualities. It was inexplicable, and as far as conscious thought was concerned, was dropped. But that other self, that wonderful unconscious cerebration of ours, took it up, solved the problem, and the next day with a suddenness that startled, thrust before me the unpoetic answer—that Hogshead! Then the writer spoke to that other self somewhat in this way: "You are wrong! I now recollect that on a dull and cloudy day, I took a small bottle of water from that hogshead to see what infusoria it contained, and that I thoughtlessly added part of it to the vessel of *utricularia*, and part to the saucer of *chara*. The hogshead stands on the top of a trestle-work forty feet above the earth, and the canal passes beside it. The Delaware supplies the canal in part and the hydrant wholly; if one is sweet and non-preservative, the other must be. You are certainly wrong." And the subject was dismissed with a smile of pity for such inferior cerebration.

But the next day, before my very eyes, a sunbeam leaped into the saucer, and set the dish, and the plants, and the water ablaze with glittering points. Something had happened! The *chara* was hung with festoons of crystals, it was buried in a grave of crystals; the saucer's sides were covered with masses of crystals that came off in flakes an inch square, and the water seemed viscid, and its surface was studded with diamond points. Had the hydrant run riches? Taste the water. No educated tongue is needed to name it. Dissolve the deposit, add a few drops of silver nitrate solution; but little chemistry is needed to explain what follows. Evaporate a minim on a slide, magnify the deposit, and you have an exhibition of crystalline cubes and crosses and dendritic forms in abundance. Fig. 1 shows the magnified crystal, dry and uncovered, having been formed rapidly. Salt it is, common salt! Whence did it come? out of that tank forty feet in the air? Was unconscious cerebration right, after all? Nothing remains but a three miles' walk to that lofty hogshead to settle the matter.

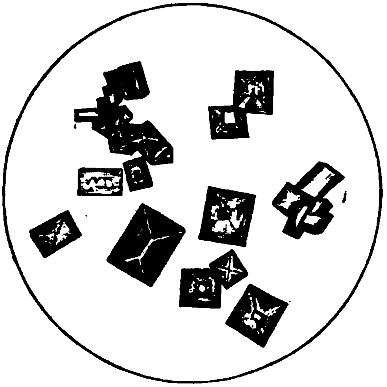
Fig. 1.

Of that bit of pedestrianism more came than could have been presupposed; it not only proved the water to be brine, but it introduced me to a new acquaintance. As I bent over the tank, whose contents were about one-third evaporated, the water seemed alive with creatures of the strangest appearance, active and beautiful; graceful animals, half an inch or thereabout in length, darting from side to side, slowly sinking out of sight, floating on their backs, and actually turning heels over head, if a creature with only a tail can be said to kick up its heels. Were they tadpoles? No tadpole ever had so exquisite a row of undulating fringe on each side of its body as this charming swimmer had. No tadpole was ever rowed through the water by such feathery oars as this bit of nature owned. A tadpole's caudal appendage is the motive power in its progression, but this new acquaintance seemed to use its long and slender tail only as a steering apparatus. Besides, the water is salt. Get out the cyclopedias, turn over the books, put the creature under a low power objective, and behold! by all that is curious, *Artemia*, the brine-shrimp! Charming as it is to the naked eye, a hundred times more exquisite is it with objective and ocular. Words cannot do it justice. To be appreciated it must be seen alive beneath the lens. I parted with all my specimens before their portraits had been taken, and on a subsequent visit to the trestle late in November, I found that the cold had destroyed them all. Fig. 2 is a representation of *Artemia gracilis*, after Verrill who first described that species, which was discovered in a situation somewhat similar to that in which the *Artemia* in the hogshead was found, namely, in a barrel on a wooden bridge, where the water gathered from a salt marsh was to be used in case of fire. I think those collected by me were also the *A. gracilis*; the figure, however, will serve to give the reader a good idea of the appearance of the lively animal that came out of the hogshead, whether it was the one species or the other.

At the first glance would one suppose that *Artemia* was first cousin to *cyclops*, *daphnia*, and *cypris*, those familiar, agile atomies of every pool; and, above all, a relative of the crabs that nibble the bathers' toes in the Cape May surf? Strange as it may seem, naturalists have found the resemblance close enough to give them all a place among the crustacea, and although the brine-shrimp's soft body is not enclosed within a shell, it has been assigned to the entomostraca, to which *cyclops* and *daphnia* belong, but to the sub-class Phyllopoda, the leaf-footed, on account of a peculiar appendage it carries on each of its feet. Its bristle-bearing feet not only add to the animal's fine appearance, neither are they exclusively useful as oars, but have the more important duty of lung-bearing, each swimming-foot carrying a breathing apparatus in the form of a flat plate. In these plates the blood circulates freely, so when *Artemia* is darting through the water it is not in search of food alone, but of breath as well.

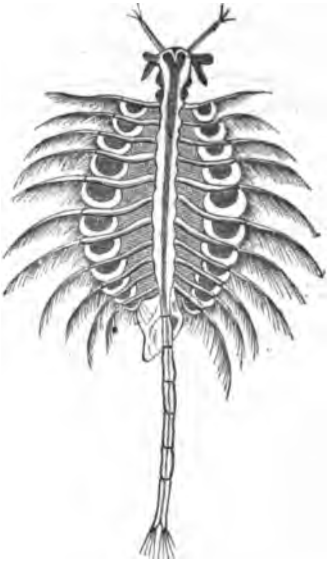

Fig. 2.

If the affinity between the adult brine-shrimp, the nibbling crab, and the one-eyed cyclops, is a surprising thing, what could be said of the creature shown in Fig. 3, when compared with the *Artemia* of Fig. 2? yet, the latter may be the mother of the former, for Fig. 3 is the young *Artemia*. It enters its briny world in such a condition of queerness, that its own mother would not know it. Could a graceful creature with twenty-two legs and with a pair of pedunculated eyes, recognize as its offspring a nondescript something with four legs and one ocular organ? However, with every moult the young shrimp lengthens out and adds to the number of its legs, as well as to its beauty.

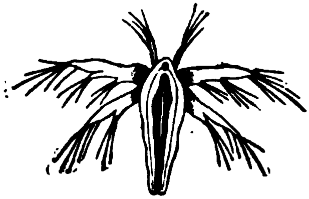

Fig. 3.

In the evaporating pans at salt-works, when the liquid has reached such a degree of density that a pint contains a quarter of a pound of salt, the brine-shrimp appears in abundance, and it is asserted as a curious fact, by those who have studied the subject at the salt-works, that *Artemia* is never seen in the vats to which sea-water is admitted, but only in the reservoirs where the salt is finally deposited, and which never become quite dry. Dr. Carpenter, in his "Zoology," says of them: "The reservoirs in which they are chiefly found, are called 'clearers,' as the liquid becomes clear in them; and this is attributed by the workmen to the rapid motion of the feet of these little creatures; and so firmly are they persuaded of this, that, according to Mr. Rackett, they will transport a few brine-worms, as they call them, from one saltern in which these animals are abundant, to another in which they do not make their appearance."

A great addition to its beauty and attractiveness is its transparency. Under the microscope most of its structure is visible without preliminary preparation. The whirling and oscillating motion of the blood, the internal anatomy of the body contents, are easily studied. Even the structure of the eyes can be made out with no great amount of work. And most interesting objects those eyes are, as they stand upon the extremities of their translucent peduncles.

Artemia is agreeable company, but like other pleasant things, cannot always be had when wanted. Indeed, the collection of microscopic material from ponds and streams is generally attended by some annoyance. The sight of a sane man poking about in a ditch is sure to attract attention, but the advent of a fellow in eye glasses, apparently playing with a bottle in a hogshead forty feet up in the atmosphere, is a mysterious phenomenon, and the neighborhood acts accordingly. I said to one of the company who crowded about me as I fished for brine-shrimps, a blackened and battered man, an iron bar across his shoulder, "Where did the water in this hogshead come from?"

"From the canal, sur."

"What makes it so salt?"

"Bless you, sur!" he said, as he kindly stirred it for me, "we puts it in to keep it from freezin'."

So simple, and yet so hard to think of! A. C. S.

Trenton, N. J.

Air Bubbles.

WITHOUT attempting to perpetrate a pun, it may be truly said that air bubbles are the *bêtes noires* of the microscopist. They present themselves where least expected, and when a beginner, at least, looks at a slide containing them, his first exclamation is: "What are those curious round black things?" It is true, that unless in the case of slides prepared for sale, or for exchange, air bubbles do not do much harm, except when they cover some unique and important part of the specimen. Indeed, it often happens, that although present, they are not even observed by the experienced microscopist, just as objects lying on the table are unseen, or unobserved by one eye, even though it be open, provided we are looking intently with the other eye through the microscope. A curious, but well-known instance of the power of attention over vision.

Air bubbles are, however, unquestionably a disfigurement, and may be a serious injury to a specimen, and it is well to know how to avoid them. This can only be done successfully by studying the causes which produce them.

Air bubbles may be divided into three classes: 1. Those consisting of atmospheric air; 2. Those consisting of the vapor of some volatile liquid, such as ether, chloroform, turpentine, etc; 3. Vacua. The third class are always produced from the second, and owe their existence to the fact that while the vapor has been absorbed by the surrounding medium, (Canada balsam, Damar varnish, etc.), that medium has been too firm to yield to the pressure of the external atmosphere, or has been protected from such pressure by the cell and its cover. Air bubbles of the second and third classes generally disappear after a time, especially if the slide be exposed to a temperature high enough to soften the medium, and, indeed, they almost always disappear during the process of slow baking to which some microscopists subject their specimens. Hence, those who use solutions of balsam in ether, benzole or chloroform, and who see the numerous bubbles which at first are present, entirely disappear, are apt to tell us that it only requires time and a little heat to remove all bubbles. This is certainly not the case with bubbles filled with air. Such bubbles never disappear, and if they should be entangled in the tissues of the object itself, it is almost impossible to remove them by any means short of commencing the whole process of preparing and mounting anew.

The air which annoys us in the form of bubbles, may be derived from one or more of several sources. 1. It may have existed in the object itself, either dissolved in the liquids or entangled in the tissues; 2. It may have been dissolved in the mounting fluid, where aqueous solutions of salts are used; 3. It may have been adherent to slide, cell or cover. 4. Or it may have simply been entangled as an air bubble in the mounting medium—balsam, glycerine, etc. These cases we shall consider separately. 1. Air existing in the object itself is the most frequent cause of bubbles with beginners, and this air may exist either free in the cells and tissues, or dissolved in the fluids. All animal and vegetable fluids contain air in solution, and when they are mixed with alcohol or glycerine, their power of dissolving air is so far lessened, that the latter is set free, and appears as bubbles. If the object be cellular, and saturated with the natural fluids, the addition of alcohol or glycerine is very apt to set the air free in the cells, and in that case, it becomes very difficult to remove the bubbles so produced.

To remove the air which exists, either free or dissolved, in any object, we may use either an air pump, or water. The air pump is generally recommended by writers on the subject, the method of using it being simply to exhaust the air from around the object, when the bubbles will expand and break. And as liquids do not dissolve air freely, except under pressure, the air pump enables us to get rid of the dissolved air also. It is obvious that there is a limit to the use of the air pump, in the fact that if the medium (balsam, glycerine jelly, etc.) be too viscid, the bubble will not rise to the surface and break, but will simply keep expanding and contracting as the pressure of the air is removed and restored, and these operations may be carried on for ever without producing any permanent good. The obvious remedy for this is to heat the slide by means of a block of metal or stone placed under the receiver. Balsam and glycerine jelly may then be rendered so limpid, that the bubbles will rise and burst of their own accord. We confess, however, that we dislike the use of the air pump. It is troublesome and inefficient compared with other means at our command.

For removing air from microscopic objects of any kind that will bear immersion in it, the best agent is recently boiled (but cold) distilled water. Cold water has a strong attraction for air, and will soon dissolve every particle of it out of any tissue or other object. The minute shells of foraminifera which have been dried and filled with air, may have the latter entirely dissolved out by a short immersion in water which has been previously freed from air by boiling and then cooled. Boiling water dissolves very little or no air; we can, therefore, expel all the air from water by boiling it, and when again cooled, it is in precisely the condition required for taking up a fresh dose. Immersion for a short time in such water, removes all air and the object may then be carried through alcohol and essential oil to balsam, without any difficulty.

When objects like foraminifera, which contain air in open pores, and which are not injured by heat, are to be mounted in balsam, the easiest and quickest method of expelling the air, is to boil them in ethereal solution of balsam. The boiling should be performed several times, the slide being cooled between each operation. In this way, the ether penetrates the cavities, and when it is boiled, the ethereal vapor carries with it a large portion of the air, so that a few repetitions of the process removes all the air. But there are many objects which cannot be boiled without injury. For them the water process is the best.

2. Aqueous solutions of salts are not used now as much as formerly for mounting objects. Where they are used, however, it is necessary to see that they have no air dissolved in them, and this can only be secured by constant care. They must be kept closely stoppered, the bottles small and well filled, and they must be frequently boiled to expel the air that will inevitably be dissolved by them.

3. To all surfaces of glass and metal, air adheres with wonderful tenacity. Writing as we do, for beginners, we feel that many of them do not realize this, but there is no fact more firmly established, and the air which adheres to slides and covers, and to the interior of cells is sufficient to form bubbles of con-

siderable size. It may be removed, however, by several methods. 1. Heat is a most efficient means. Slides and covers which have been recently heated, are generally free from air, and balsam, and glycerine jelly, may be laid on them without the formation of bubbles. 2. Liquids like alcohol and turpentine, displace the air. Where cells of some size are to be filled with balsam, it is best to fill them first with essential oil of turpentine, in order to displace the air. This is an old plan and a very good one.

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Hints on the Perservation of Living Objects, and their Examination Under the Microscope.

BY THOMAS BOLTON, F.R.M.S.

(Continued from page 151, Vol. IV.)

I WILL now give a short summary of the most useful apparatus for the examination of living objects. The simple glass slip, 3in. by 1in., or better, a ledged stage-plate 3in. by 1½in., with narrow strip of glass cemented along one edge. One of these, with cover-glass, is often all the apparatus necessary to use with small infusoria and free-swimming rotifers, and is also occasionally available with a little management for larger objects, either free or attached. Manipulation with these I cannot better describe than in the words of Judge Bedwell, in his description of what I call Bedwell's rotifer-trap.

"Take a plane glass slide, on it drop one or more of the rotifers in a drop of water, about half an inch in diameter, and draw off the surplus water, if any, carefully with the empty pipette; then fray out a very, very small portion of cotton wool (I always use a watchmaker's glass in the eye to do all such operations) until it is much extended, and spread out and lay this on the drop. Upon that lay the thin microscopic glass, the thinner the better, and then set up the capillary attraction by gently touching it with a needle. Draw off any superfluous water from the edges with the pocket-handkerchief, and you will have a little wilderness of wool in which the rotifer is restrained in its movements, protected from pressure, and within reach of very high powers. The amount of wool depends on the size of the rotifer. Hydatina requires more depth than rhinops. The same plan answers equally well for all roving animals. The poduridæ in particular, when placed in deep glass cells, are easily seen by this apparatus, and it saves many a weary and vexatious five minutes with the compressorium, which even at the best, requires with living animals extraordinary patience. The rotifers are easily found and secured with the pipette and a watchmaker's glass in the eye, after a very little practice. Mr. Bolton's studio is of the greatest value to naturalists, and cannot be too well known, for to those who have not time to look for specimens it is a great privilege to be able to purchase them."

Another simple apparatus I call the Wills' compressorium. Most forms of compressorium are useless—all are expensive. Those who try the following will be surprised at the efficiency of the apparatus. Two pieces of thin glass are cemented on to a glass slip in the shape of the letter L, but with the two strokes of the letter about equal in length, and another thinner and longer one is fixed longitudinally, thus L—— The L serves to retain in position a square slip of cover glass placed, of course, not on the L, but inside it; the horizontal piece, which should be ground to a bevel on its top edge before fixing it, serves to carry a fine needle, the point of which is inserted beneath the edge of the cover glass. This point being tapered, it is easy to increase or diminish the thickness of a film of water carried between the cover and the slip by pushing the needle further in or out, and so to form a cheap and effective compressorium.

Animalcule Cage and Compressorium.—The ordinary animalcule cages are often used for examination of entomostraca, larvæ, etc., with transparent light, but cannot be used for dark-field illumination, either with paraboloid or central-stopped condensers. A good compressorium is very useful; I have myself generally worked with R. and J. Beck's parallel compressorium, or their reversible compressorium. A good and cheaper form has just been made under the direction of Mr. Graham, president of our Birmingham Natural History and Microscopical Society, which will be very useful, as it gives a good range of depth, and is readily manipulated.

Hollow Cells.—These are ordinary slips of glass 3in. by 2in., with a slight hollow ground in the centre, in which a drop of water can be placed and covered with thin glass.

Tube Cells.—These are very useful, and can be made by cementing with marine glue or gold size, on ordinary glass slips, either vulcanite tin, or glass rings. These are filled with water containing the objects for examination, covered with a thin glass cover, which will be retained in its position by capillary attraction.

Tube-Cell Troughs.—Tube cells may be conveniently converted into most useful little zoophyte troughs by cementing a semicircle of thin glass on the lower half of the cell.

Thin Glass Slide Troughs.—These are made of glass slips, 3 in. by 1 1-3 in., to which are cemented slips of thin glass 2in. by 1in., out of which a semicircle of ¾in. radius has been cut, and then covered with another thin glass 2in. by 1in. It is well to have an assortment of these, of different thicknesses or depths, and for those of greater depths it is more convenient to make the distance-plates of vulcanite instead of glass. These troughs should always be washed out directly after use, but if dirty, are best cleaned under a stream from a water-tap, with a wooden smoking-spill, the thickness of which can be readily reduced, if required, with a knife. In using these troughs, great care should be taken to have the top edge, face, and side, quite dry, as, if in filling them any moisture is allowed to remain outside, capillary attraction is very apt to commence and cause the water to escape *over the edge*, especially if any fine fibres of algæ are present, which will often act as siphons. By omission of this precaution such troughs are often condemned as leaking when the fault is in the manipulation; but if a trough is found to leak it should be carefully dried, and the outside edges carefully painted over with one or two coats of gold size. One or two of the ordinary large zoophyte troughs will also be occasionally wanted for large objects.

An Easy and Simple Method of Resolving the Finest-Lined Dry Diatomaceous Tests, Mounted on Cover, with Special Reference to Amphipleura Pellucida.

BY ADOLPH SCHULZE.

THE object of this article is to call attention to an excellent method of resolving the finest-lined tests, mounted dry and on cover. This mode of illumination I discovered in the course of my attempts at resolution, but I doubt whether I have been the first to employ it, as it is really so very simple that others can not have failed to discover it too, but as I read and hear continually of the great difficulties in "checking" *Frustulia saxonica*, and in "lining" *Amphipleura pellucida* even with the best objectives I cannot but assume that the method is not generally known, hence my reason for describing it.

When I succeeded in resolving *Amphipleura pellucida* in balsam, by means of the Reflex Illuminator, I became aware of the great value of immersion condensers as a means for the utilisation of the full apertures of immersion lenses, but I saw at the same time that *substage* immersion condensers would only be of value for objects mounted in balsam or for objects mounted dry on the slip, whilst for objects mounted dry on the cover they were practically valueless, because rays of the requisite obliquity, emanating from the substage immersion condenser, have so great obliquity that they are totally reflected internally from the upper surface of the slip, and so never pass through the layer of air to the object. It was, therefore, clear that immersion condensers for the oblique illumination of objects mounted dry on cover could not be substage, but must be *superstage* ones, *i.e.*, condensers joined to the upper surface of the cover to which the diatom or other object adheres. The *immersion objective itself* presented the first claim as a superstage immersion condenser, and the oblique illumination was readily obtained by the interpolation of a so-called *vertical or opaque illuminator* between the nosepiece and the objective.

The vertical, or opaque illuminator, was originally constructed for viewing uncovered opaque objects with dry front objectives, and it consists simply of a short tube, having a small circular aperture in its side, and a reflector movable on a horizontal axis inside this tube. In its simplest form, in the patent opaque illuminator of Messrs. R. and J. Beck, the reflector consists simply of a thin circle of covering glass. Messrs. Powell and Lealand use a plate of parallel glass, and Professor Hamilton L. Smith, of Hobart College, U.S., the inventor of this apparatus, uses a small silver speculum, placed on one side of its horizontal axis, whilst in another form there is a small rectangular prism covering half of the aperture. Messrs. Powell and Lealand add a small diaphragm with four circular apertures of various sizes, of which the smallest appears to me to be the most useful, as the larger ones produce too much glare.

The *modus operandi* is the following: Place the tube of the microscope perpendicularly, or nearly so, screw the vertical illuminator between the nosepiece and the immersion objective, so that the aperture through which the light is to fall stands in front. Then place the lamp, the narrow side of the wick turned towards the microscope, right in front of the latter, at a distance of from six to ten inches. After having roughly focussed the lens on the side, adjust the lamp in a vertical direction, so that a line perpendicular to the optical axis of the microscope, drawn through the centre of the aperture of the vertical illuminator, passes through the lowest point of the flame, or just over the top of the wick. Adjust now the reflecting surface of the vertical illuminator on its horizontal axis so that a distinct image of the flame appears in the field of vision. This image will, of course, appear brightest, and the definition best, when the narrowest side of the flame is turned towards the instrument, which can be easily ascertained by turning the oil vessel of the lamp a little round its axis, whilst looking into the microscope. The field is now quite dark, and nothing is seen but a streak of light about a quarter of an inch in breadth, which passes through the middle of it antroposteriorly. If all this has been carefully attended to, and if a diatom, adhering closely to the cover, is moved in this image of the flame, its markings will appear most beautifully and distinctly resolved, provided that they are lying *across* the path of light. Various little advantages may be gained by a more careful regulation of the relative heights of the light to that of the aperture of the illuminator, or by shutting off one half of the aperture of the latter, or by allowing the light to fall only on the lower half of the aperture, etc., all of which have for their object tolet the light fall on only one half of the reflecting surface, leaving the other for the passage of the rays from the object to the eye piece. The image of the flame does not always intersect the whole of the field, and in this case it falls more in the forepart of the same. The Dallinger lamp gives a high flame, and consequently a very long intense image dividing the field into two halves, whilst the motions of this lamp ensure a speedy and accurate adjustment. Carl Zeiss's water immersion lenses, especially the 1-8th; Powell and Lealand's fine new formula water-immersion, 1-8th, and those magnificent oil-immersion lenses*, the 1-8th, 1-12th, and the 1-18th of the former maker, are those I have tried in this way, and with all of these I have succeeded in obtaining resolutions of the finest-lined diatoms in a way not to be obtained by achromatic condensers, prisms, lenses, &c., by transmitted lamplight.

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* On Stephenson's system.

Amphipleura pellucida resolved in this manner shows its outlines with the greatest distinctness and without appearing in the least degree distorted. The ribs are clearly defined, and the mid-rib reveals a fine black line running along its middle, whilst the cross-striæ appear black and beautifully separated, extending over the whole floor of the valve on both sides of the mid-rib, and between the marginal rib, and between the latter and the broad ends of the former. This diatom assumes an olive or light green hue, according to the objective used. Under a power of 400 diams. the markings on the smallest specimen become distinctly visible, and with sufficient amplification they may easily be counted by the flame of an ordinary paraffin lamp, having a wick one half-inch broad. Beautifully as these cross-lines are resolved, I cannot see any longitudinal lines, not even with the 1-16th oil-lens. I am of opinion that many who honestly believe that they can well resolve *Amphipleura pellucida* will readily grant, after having seen the resolution of this diatom with the vertical illuminator, that they have been laboring under a delusion, and that they have only well succeeded on abnormally marked valves.

Frustulia saxonica, Navicula crassinervis, or *Navicula rhomboides*, are easily lined or checked, according to whether their mid-ribs are lying in the direction of the image of the flame, or at an angle of about 45° to the latter. Even on damp slides of *Stauroneis spicula* (of which there seem to exist more than of good ones), the cross-lines on this diatom may be readily and distinctly seen.

Surirella gemma assumes an olive-green color on that part which is in close contact with the covering glass, and shows rows of exquisite, small, and regular hemispherical beads, but by no means hexagonal markings.

Navicula cuspidata assumes a beautiful iridescence, and shows its elongated beads to perfection, and is altogether a lovely object.

Pleurosigma angulutum shows its markings as regular, small, and widely-separated beads. Take any diatom you like, and the result on that part with which it adheres to the cover is equally satisfactory and often surprising. It is easily seen whether an object adheres to the cover or not, as in the latter case its outlines appear ill-defined, and the whole as in a haze.

I sum up the *advantages of the mode of illumination here described* under the following heads:—

1. The *correctness* with which objects and their details are seen.

2. The *ease* with which the most difficult resolutions are obtained as the veriest tyro in microscopical illumination may with a suitable objective, resolve the most difficult diatomaceous tests known, in a few minutes time.

3. The *simplicity and cheapness of the apparatus* employed, the vertical illuminator being obtainable at so low a cost as about twelve shillings.

4. The *adaptability of the illuminating apparatus employed to the simplest stands.*

5. The value of this method as a *means* of expeditiously *testing objectives* with regard to the utmost limits of their resolving power, and under the most favorable illumination, because the illuminating ray impinges on the object at just that greatest angle at which the objective is capable of receiving, or of transmitting the same.—*Journal Quekett Microscopical Club.*

The Vertical Illuminator and Homogeneous-Immersion Objectives.

BY J. W. STEPHENSON; F.R.A.S., TREAS. R.M.S.

THE Fellows will have seen in the April number of the Journal (p. 194) a note extracted from the 'American Naturalist' for February, in which are described the advantages found by Mr. Morehouse, of New York, to be obtained from the use of the Vertical Illuminator* in the resolution of Diatoms and Podura scales.

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* As several inquiries have been made as to what instrument is meant by the "Vertical Illuminator," I may refer to Dr. Carpenter 'On the Microscope,' 5th ed., p. 153, where the instrument is both described and figured. A small silver speculum (Professor Smith), or a movable disk of thin glass (Messrs. Beck), or a piece of parallel glass fixed at an angle of 45° (Messrs. Powell and Lealand), is fixed in a short tube (with a side aper-

On reading the note, I tried the apparatus on both classes of objects, and can fully endorse the statement made as to the surprising results obtained. Slides of *A. pellucida* which were deemed worthless because all the striæ had, as was supposed, been destroyed in cleaning, were resolved with the greatest ease, and Podura showed parallel light or white lines from one end of the scale to the other, somewhat reminding one of Lepisma. The Vertical Illuminator was soon after its first invention discarded by practical microscopists on account of the amount of fog which was caused by the reflection, at the upper surface of the cover-glass, of the rays transmitted through the objective. It is obvious that *this* fog will not be observed when an oil-immersion objective is used, as in that case the front lens of the objective, the intervening stratum of oil, and the cover-glass itself, are all optically continuous, so that the upper surface of the cover-glass has optically ceased to exist, the only reflection being from its under surface when dry objects are used. An additional advantge is therefore found for homogeneous-immersion objectives.

My object is not, however, to deal with this branch of the subject, but with an entirely different application of the Illuminator, not noticed by Mr. Morehouse, but which appears to me to be of great scientific interest.

This point is the *visible* demonstration which the Vertical Illuminator affords, not only that many modern objectives, and notably those on the homogeneous-immersion system, have angles far exceeding the equivalent angle of 180°, but also that the extent to which this excess is in any particular case carried, can at once be appreciated.

The existence of this excess, although at one time doubted, has since been abundantly proved, and the present method affords an ocular demonstration of the fact, most conclusive in its character and fully supported by theory.

It will be seen, on removing the eyepiece of the microscope, after having reflected a full beam of light through the objective, by means of the Illuminator, and after having focussed the instrument on any dry object adhering to the cover, that within the margin of the lens there exists a brilliant annulus of light, and that the circumscribed internal space appears by comparison to be quite dark.

This annulus represents, and is produced by the excess of aperture beyond the equivalent angle of 180°, or what is called the "*plus* 180°," of which it is also the measure.

The internal dark space is of the exact diameter of that of a dry objective of the same focus, and is in fact the maximum space which it can itself utilize, on a dry object, by transmitted light.

On looking down the tube of the microscope on which is one of Zeiss's homogeneous-immersion $\frac{1}{8}$ths, with its numerical aperture of 1·25, it will be seen that the annulus has an apparent magnitude corresponding with that attributed to it by theory, that is to say, a width equal to one-fourth part of the radius of the dark central space.

The explanation is, as it appears to me, simple enough: the beam of light reflected by the parallel glass plate of the Illuminator, is condensed by the objective, and brought to a focus on the under side of the thin glass cover, the oil (or other homogeneous fluid) having, thus far, allowed the light to be freely transmitted; but, at the focal point, having to pass from a denser to a rarer medium, the passage of all rays which exceed the critical angle (in this case 41°) is arrested, whilst those within that limit, or at all events the greater part of them, pass through the glass and are lost.

The bright image of the flame of the lamp, which is seen crossing the field of view, is therefore almost exclusively formed by the "*plus*," rays which, being totally reflected as soon as they impinge on the air surface of the cover-glass, are sent back by the peripheral portion of the objective to the eye; it is thus evi-

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ture) interposed between the objective and the body of the microscope, by which means a pencil of light entering at the aperture and striking against the speculum or inclined surface of the disk or plate, is reflected downwards through the objective upon the object.

dent that unless the objective possessed the excess of aperture which we have been considering, the image could not be formed by the totally reflected rays, nor, if formed, could the reflected rays be taken up by the objective and transmitted to the eye.

These reflected rays, when seen without the eye-piece, form the bright annulus of light, and constitute, as has been shown, the aperture in excess of the 180° limit, which limit is itself as clearly indicated by the dark central area.

That this is not a mere theoretical or nominal increase is evident when we consider the areas of the transmitting portions of the lens, which are proportional to the squares of their numerical apertures or as 1 to 1·5625, so that the Vertical Illuminator picks up the 0·5625 as against unity, which is the *ideal* maximum of the dry lens.

It is truly stated in the 'American Naturalist' that the vertical illuminator "can only be successfully used in conjunction with an objective of high balsam angle," and I hope the reason of this has been rendered clear.

In examining a dry object with reflected and transmitted light, the optical phenomena are reversed: with reflected light we have the bright annulus and dark centre; but, with light transmitted from below, we have the central portion of the lens traversed by the illuminating pencil, which is, however, unable to penetrate the dark circle by which it is surrounded.

On objects mounted in balsam (or fluid) the Vertical Illuminator fails, as far as resolution is concerned, and it is on these that the various sub-stage immersion illuminators come into play, their greater or less success depending exclusively on their ability to induce the dioptric beam to penetrate the magic circle beyond the limit of 180°, as unless the light can be seen to touch the margin of the lens, its full power has not been developed; hence it appears that "vertical" illumination, in some form, is the only means by which the whole of the resolving power of large-angled objectives can be utilized on dry slides, just as on balsam objects immersion illuminators are indispensable.

In the foregoing observations I have throughout spoken of the bright *ring* of light, and this may lead to the impression that the whole of this ring is used, but this is not so; in practice only a small portion is employed, the greater part being shut off by a suitable *external* diaphragm or stop, just as with immersion illuminators in the sub-stage a part only of the marginal rays are employed.

This seems to suggest the substitution of a small totally reflecting prism for the parallel plate of glass, which, projecting slightly over the margin of the lens, gives a much more brilliant beam of light, but it has the disadvantage of, to a certain extent, interfering with the diffraction spectra, and thus under some circumstances, so diminishing the aperture of the glass, as to interfere with its resolving power.

The Vertical Illuminator was originally intended to be used more as a Lieberkuhn for opaque illumination with medium powers, its present use not having been foreseen. That it can be so used with even greater effect on balsamed objects now, when homogeneous immersion objectives are used, is obvious, because the light passes as direct as it formerly did on to uncovered objects in air, both the upper and under surfaces of the thin glass cover having been optically abolished—but the number of balsam objects suitable for opaque illumination with powers as high as an $\frac{1}{8}$, is very limited.—*Trans. Royal Mic. Soc.*

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Work for the Microscope.

THE following remarks, extracted from the address of Prof. Huxley, F.R.S., as President of the Quekett Microscopical Club, are so full of hints to every owner of a microscope that we commend them to the careful reading of all our subscribers.

Since I have held the honorable position of President of the Club, my attendance at your meetings has impressed me very strongly with the great amount of instrumental perfection which is to be observed on those occasions; and I do not think that any one could fail to be struck with the skill displayed in such work, nor could he fail to admire the great patience, the perseverance, the devotion of time and energy displayed by the members of the Club in the pursuit of microscopy.

No doubt one might say that a very large result of this activity is simple amusement; but I happen to be one of those people—perhaps because I got so little of it myself—who think that amusement is an exceedingly good thing; and I am strongly disposed to think the beneficial effects of such amusements as do no harm to a man himself, nor in any way rob his neighbor—especially such as are found in microscopical studies, heightened by the sympathy of those who are associated for the purpose—are very great, and that they are much to be cherished as an important part of the good of human life. So that if it happened that no member pursued the subject for a higher purpose than the gratification of his taste for the beautiful, or the exercise of manipulative skill, I, for one, should think the time of the Club exceedingly well spent. But happily no one, whatever be his object, who works at the business of the Club, can end in simple amusement. He is dealing with natural objects, and every new thing observed, every fresh beauty discovered, is something added to the stock of natural knowledge; and every improvement of his instrument makes it a better weapon of scientific research. And not only so, but the habit of mind which creates the possibility of finding amusement in pursuits of this kind, is invaluable as a preparation for the reception of scientific truths, and the cultivation of scientific methods. If I may say so without offence, such amusement may be regarded as an involuntary ploughing and harrowing of the ground, making it receptive of the seeds of science, and preparing it for rich harvests in the future. So, as I said before, whatever member of the Club has joined it for the sake of mere amusement, has done a good thing for himself, and has done probably more than he knows to help those who make these pursuits the serious business of their lives.

But whilst recognising the legitimacy of following out such pursuits for amusement only, I have a sort of feeling in regard to them such as an old recruiting sergeant might be supposed to have whilst looking at a band of rustics sporting on a village green, or at a number of volunteers going through their evolutions. These atheletic exercises and this playing at soldiers are all very well in their way; but the recruiting sergeant with an eye for a man, will see that the sport is training those who have a vocation for the realities of war, and is leaving them to feel their way towards taking part in more serious business. Many of the papers which I have heard in this room have given me the feeling that I should much like to give the shilling,[*] and putting my hand upon the readers, to say "Your proper business is to come into the army of science." And naturally I must feel great gratitude to a society like this, as one of the army of workers who looks at it with an eye to enlistment.

I must, however, separate myself from the recruiting sergeant, because he walks off with his recruit, who is seen no more in the place that once knew him; while I cannot say positively, that those of you who have a turn for really scientific work may not do better to stop where you are. In fact you have opportunities which are not possessed by the men who make science a business. The truth is that the increase of knowledge has its drawbacks, not perhaps as Solomon said—"He that increaseth knowledge increaseth sorrow;" but certainly it is an increase of trouble and an increase of worry. Whoever becomes a man of science by profession must know something pretty thoroughly, and this means that he must not only know pretty accurately this or that piece of detailed work; he must have not only the knowledge of general facts, but must possess the special knowledge also, and be able to guide the one by the other, and to criticise his speculations by his knowledge of detail—this is the only title by which he can sustain his claim. But during the last quarter of a century science has taken to grow in a most portentous and astonishing fashion. I remember the time when it was quite easy for an ordinarily industrious man to keep up with the scientific literature of the period; if he made himself acquainted with what went on here, and if he read a French or German work now and then, it was enough; but, at the present day, to keep up with all that goes on, he must be a most industrious man indeed, and if he even tries to keep up with it he must do an amount of reading which is singularly demoralising to his habits of thought. If he wishes to work out any scientific points with accuracy and detail, it must be a very small matter which does not occupy him for months, and need his closest attention, during which time he will be drifting altogether away from the stream of progress of scientific knowledge. This constitutes the difficulty—*experto crede*—the great difficulty of being broad without being shallow, and of being deep without being narrow. Any one who has exceptional qualities of work or method, may perhaps be able to keep creditably abreast with the course of progress, and to do some work of his own besides; but if he is not so gifted he has before him one or other of these two unsatisfactory alternatives.

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[*] This is a phrase which our American readers will hardly understand. In England the sergeant gives each recruit a new shilling, partly as advance payment, thus paying for and securing his services, and partly because the new shilling has on its face the portrait of the reigning sovereign. Having once taken the shilling, there is no backing out. Hence, "to give the shilling," is equivalent to irrevocable enlistment.—[Ed. Am. Jour. Mic.]

But you, members of this Club, are in this respect vastly better off, because you can give your attention to any one point which you want to get at the bottom of, and you are not likely to be pulled up by some student in the lecture room who has read the latest thing published, and who expresses surprise that you do not know all about it too. Consequently you can give your attention to your own subject as exclusively as you may desire. I do not mean to say that you do not lose anything, for naturally where you have to deal with the deeper problems you will never come to any good unless you have those principles to guide you; but, for three-fourths of the problems of microscopy, although you will require neatness and skill, clearness of eye, and lightness of hand for cutting and preparing sections, the great amount of general knowledge which a man of science is required to have is of no consequence at all.

Several amongst your number have asked me to indicate those courses of inquiry which may best be commended to members of such a society as this, and it strikes me that the suggestion which I have just made supplies the answer. It is exactly in that field—the following up of details, tracing out minutiæ of structure, in occupying themselves with such questions as are only to be solved by long and patient devotion of time and dexterity, and a thorough knowledge of instrumental manipulation—it is exactly there that men of science find their difficulties, because the amount of time consumed is so great. Take, for example, the application of persistent watching to the unravelment of the life history of a vast number of low organisms; that is a process which has been adopted in respect to certain fungi in order to ascertain whether they are parasites or variations. In such a case the plan pursued is that of taking the spores and watching them step by step, and there is no other way of doing it; it involves enormous expenditure of time and great instrumental dexterity, but those who can follow it obtained results which are to be attained in no other way. The work of Mr. Dallinger and Dr. Drysdale, for instance, affords us a very remarkable example of this kind of observation: these two gentlemen mounted guard alternately over a microscope for days and days, watched one identical monad through all its stages; and they succeeded in tracing out its entire life history, and made an epoch in our knowledge of these lowest forms. Now suppose this kind of observation was to be directed to the *Infusoria* in general, what an opportunity there is for some of you! Why there is not a single genus or species of which we may say that we know the whole history. The common *Paramecium*, for instance, is one of the commonest things that exists, yet nobody certainly knows whether it has any other mode of reproduction except by fission. The skill which I have seen displayed here is of immense value in such kind of work, and if only applied to it must very soon bring some good results. The like is true also of the *Acinetæ;* we know something about them, but nothing like a complete history; and it is a perfect opprobrium to science that nobody knows what an *Amœba* is. I do not mean to say that we do not know the things we call by that name when we see them, but that we are unable to say with certainty what are their modes of reproduction, what are their various states, which are vegetable and which are animal. Turn to the study of development, the whole of which is in a progressive state. We are now carrying it so far that we can trace back a single group of organs to a particular portion of the dividing yolk mass, and the ultimate result will probably be to trace out each group of organs to the blastomeres from which it has proceeded. Thirty years ago if any one had talked of making sections of a butterfly's or a crayfish's embryo, it would have been regarded as something inconceivable; but now careful section makers will deal with these things in such a way as to be able to make you twenty sections through one of them. But as every one knows, this kind of thing cannot be followed out without a great expenditure of time and an amount of dexterity which it is not given to every one to attain.

Let me also point out that it is not necessary to go far a-field to find subjects for this kind of work; probably what is most wanted is an exhaustive study of some of the commonest things about us. The development of Rotifers, for example; why these are the commonest things in the world. Kowalewsky, years ago, made a number of observations upon the common earth worm; let us see if in his conclusions he was right or wrong. It is not very difficult to make sections of these things, and it would be of great importance to get his observations confirmed. I have no doubt as to their correctness myself, but it would be very satisfactory to have them verified. I might turn to half-a-dozen kinds of similar observations with regard to the development of insects—say the presence of an amnion in some and not in others; any one who could make minute sections would solve the problem for us. It happens that some time ago I occupied myself with a very common subject, by way of carrying out my own precept of trying to get to the bottom of something. I had various reasons for doing this with the common crayfish, and I may say that the result has been very instructive; I mention it to show how much it is worth while to take up common things, if only to find out points about them which have been overlooked. The first thing I did was to examine the branchiæ, and in so doing I found to my surprise that there were two little filaments, about 1-20 of an inch long, attached to the sides of the body. I had never seen any notice of these things, but I found by-and-bye that Brandt and Ratzburg had seen them. The curious thing about them was, that these two little filaments occupied the same position as gills, and from this I had little reason to doubt that they were rudimentary gills, and that there had been gills in that position at some time. I then thought if I could obtain some less modified forms of crayfish, such as are found still in Australia, I should be able to throw some light on the matter. I did so, and found in the place of these rudiments perfectly developed branchiæ. This led me to seek for similarities of structure in the lobster and the marine crayfish, and these again led me on to examine other *Crustacea;* and I need hardly say that the bearing of all this upon the theory of evolution from a common type was very important. From these things I was led to look into the structure of the muscles, the spermatozoa, the chitinous cuticle, the eye and other parts, and there was not one of these which did not present interesting novelties and would not have taken months of work to get to the bottom of it, so as to make oneself thoroughly acquainted with every detail. You may find plenty of work if even you confine yourself to such common things as caterpillars. Lyonet, you know, spent many years over his caterpillar, and the result was a monograph which will last for all time.

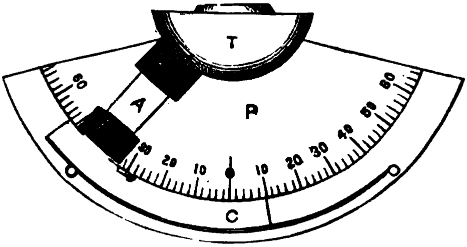
This is the kind of service which those members of the Club may perform who feel inclined for it; it is work which may be of very great value, and which certainly cannot be undertaken by those who have to occupy themselves with science as a whole.—*Journal Quekett Microscopical Club.*

An Illuminating Traverse-Lens.

BY ROBERT B. TOLLES.

WITH the advent of objectives of increased interior angle of aperture, the indispensableness of equivalent accessory means for the illumination of the object became immediately evident.*

In my first construction of such object-glasses, I therefore required to provide means which proved so suitable that I have adhered to their use to the present time.



TOLLES' ILLUMINATING TRAVERSE LENS.

The first appliance was a deep plano-convex lens, centrally mounted below the object and having its centre of curvature in the object-place. Afterwards, I adopted a plano-cylindrically convex lens, equal to a hemisphere less the thickness of the object-slide, which was placed in immersion contact with the base of the slide so that the object itself formed the centre of curvature of this illuminating lens. Around the convex surface of this central lens moved a shutter to regulate and limit the access of light, and it was provided also with a small plano-concave lens which, applied by its concave to the convex surface of the larger lens by immersion contact, cancelled the refracting surfaces and allowed a perpendicular *beam* of light to reach the suitably immersed object without refraction.*

The device in a more complete form is represented in the annexed figure, where P is the basilar plate of the whole traverse system, having a circular groove and track in which the carriage, C, moves. On a projecting arm, A, of the carriage, C, are mounted whatever appliances are to be used to modify or direct the light upon the traverse lens, T, in the direction of the object at the centre of the system.

In the figure the concave lens, N, is shown in position on the arm. Thus situated, the interior convex and concave surfaces being of no effect, the two exterior plane surfaces of *the traverse system* constitute it a prism, and every slightest movement of this concave facet lens on the traverse lens, T, would *give a different prism* to infinite variety. In this arrangement, the concave mirror can be used in the ordinary manner and condense light enough upon the object for all ordinary purposes. The full interior aperture of a dry objective would be reached at the very convenient obliquity of 41°, i.e. at less than the critical angle, or angle of total internal reflection between crown-glass and air. L is a double-convex condensing lens, that may be placed at about its principal focal distance from the object.

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* See 'M.M.J.,' July, 1871, p. 38.'

* M.M.J., May, 1873, p. 213.

For a condenser, with the size of apparatus as drawn in the figure, a simple lens of 1¼ inch focus and about ten (10°) degrees of aperture is convenient, and if the lens is movable along the arm, A, it can be focussed readily on the object, the position being fixed by inspection. This would be well for parallel rays. If diverging rays are used another lens of two or three inches focus, mounted on the arm, A, will conveniently take up the rays from the radiant at the distance of the focus of this supplementary lens.

The plate, P, is graduated on its circular edge, as in the figure, to two degrees. and the arm, A, has a swing of seventy degrees of arc each way from the axis of the microscope. An index-line is marked on the bevelled edge of the carriage 10° from the axis of the condenser, which must be added to or subtracted from the real obliquity of the illuminating rays.

It is obvious that any observation made and duly recorded as to its conditions, as of obliquity of incidence of illuminating pencil or ray, form of the pencil or beam, focal length and distance of the condenser, such observation could be successfully repeated. The record of the obliquity of the most oblique rays reaching the object directly and giving view of it at the eye piece with luminous field, would express the "balsam" aperture, or more correctly, the half interior aperture of the objective when the front lens of the objective and the traverse system are of glass of similar refraction.

Having thus the "balsam" angle we readily calculate or learn the corresponding angle for glycerine, or water, or any medium of which we have the index of refraction. A corresponding notation, perhaps for air, might be engraved in juxtaposition on the basilar plate.—*Jour. Royal Mic. Soc.*

Deceptive Appearances Produced by Reagents.

A paper recently communicated by Dr. George Thin to the Royal Society* under this title, was intended, in addition to being a contribution to the histology of hyaline cartilage, to illustrate how much the apparent structure of a tissue which is being examined microscopically depends on methods of preparation.

In the examination of a cartilaginous tumour of the lower jaw, the author was able to isolate the cells from the cartilaginous substance of the tumour after the action of osmic acid. All the cells observed were flattened, rounded, or somewhat polygonal bodies, with round nuclei. Their contours did not correspond exactly with those of the rounded cartilage "capsules" in which they lay.

The examination of this tumour showed that most delusive appearances as regards the nature of cartilage cells may be sometimes produced by staining and hardening agents. Carmine and eosin, by staining an unformed substance that exists in the structure in defined tracts, may simulate branched protoplasmic cells, and bichromate and logwood preparations, either in sections or teased out, may as closely simulate cells with fibre processes.

These facts justify, the author considers, serious doubts as to the correctness of interpretation in all cases in which histologists have described branched cells in hyaline cartilage, whether the latter existed as a normal structure or as a pathological growth. They further show that, taken alone, carmine or eosin-staining should not be held as conclusive evidence of the existence or limits of cellular protoplasm in any animal tissue.—*Jour. Royal Mic. Soc.*

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Cells.

Some years experience has now convinced us that cells formed as directed on page 138 of the second volume of this journal, are not only neat, serviceable and easily made, but very durable. We have some on hand, and when the slides are broken, the cell breaks too, instead of parting from the glass. The cells are made of litharge and gold size, and are not only laid down on the turn-table, but, after being slightly dried, are "turned" there by means of a very light, sharp chisel. If well coated with shellac varnish, or Bell's cement, they hold liquids perfectly. Being turned true and clean, they have a very neat appearance, and may be made of any size without extra tools.

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* 'Proc. Roy. Soc.,' vol. xxviii. (1878) p. 257.

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The following gentlemen have kindly consented to act as agents for this Journal, and are authorized to receive subscriptions and advertisements:

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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the American Journal of Microscopy. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Articles on Hand.

AMONG the articles on hand for our next issue, we have a very able and thoroughly practical article by Dr. Blackham on "The Method of Using Wide Angle Objectives;" one on the Character of the Diatomaceæ, by Kutzing, translated by Prof. H. L. Smith; one on *Argulus Stizostethii*, by Prof. Kellicott of Buffalo, besides the usual notes, clippings, transactions, correspondence, etc.

Our Fifth Year.

IN entering upon the fifth year of the publication of the American Journal of Microscopy, a short review of what we have done may not be out of place.

When we issued the first number in 1875, the condition of microscopy in this country was very different from what it is to-day. Two attempts had been made to establish journals devoted to the subject, and both had failed. The *Cincinnati Medical News*, and the *American Naturalist* were the only journals which professed to have a microscopical department, and in neither of these did the matter published ever amount to enough to make it worth while for the average microscopist to take them for this alone. We observe that lately the *Medical News* has dropped this department entirely. The *Naturalist* still gives one or two pages of microscopical matter, edited by Dr. Ward, of Troy, N. Y.

Indeed, at that time, the San Francisco Microscopical Society, under the able secretaryship of Mr. Kinne, did more, through its published reports, to foster microscopy than any other literary agency in this country.

The only microscopical societies in New York at that time, were the American and the Bailey Club. The latter is a private club, more social than microscopical, and the American Microscopical Society was in a very inactive state. The other active societies numbered about thirteen throughout the whole country.

Such was the condition of affairs when we issued our first little sheet of twelve pages at fifty cents per year. This at once gave an impetus to microscopy, by bringing the workers in different parts of the country together, and stimulating all to increased efforts. The publication of the transactions of the different societies, induced the formation of new societies at New York, Rochester, Camden, Detroit, and other places. The manufacturers of microscopes found an enlarged field for their goods, and a firm, the Bausch & Lomb Optical Co., new to this department, undertook the manufacture of first-class microscopes, and produced instruments which, for quality and price, had not before been seen in this country.

Three other factors, which should not be overloooked, have entered into the combination of circumstances which have recently advanced the cause of microscopy in this country. These are, the Centennial Exhibition, the American Postal Micro-Cabinet Club, and the American Society of Microscopists. We have not space now to give them full consideration, but shall return to the subject at an early day.

In 1877, induced by the urgent solicitation of a large number of our subscribers, we doubled the size and price of the journal, making the latter one dollar. It will hardly be credited, that this slight increase in price, cut down our subscription list by fully one-third, but such was the case, thus showing that high priced journals cannot be supported here. Since that time a *Quarterly Journal of Microscopy*, at three dollars per year, has been started, carried through four numbers, and suspended. There is now talk of another journal, at one dollar per year, and also of one at fifty cents per year. For ourselves we say, the more the better.

In establishing purely scientific journals, great difficulty has always been found. If, by great care and economy, and by judicious enterprise, both ends can be made to meet, the conductors are doing well. The numerous failures which have occurred, amply prove this, and the present condition of all journals devoted to *pure* science tells the tale still more strongly. The *Naturalist* has never met the support which it deserved, and we doubt if any purely scientific journal at present published would be carried on if it did not secure extraneous support. The same is true of other countries. When the Royal Microscopical Society withdrew its support from the Monthly, the publishers at once abandoned it. In France, Dr. Pelletan's journal has suspended, after bringing financial trouble on its projector.

We make these remarks in explanation of our persistent refusal to enlarge this journal. We have been constantly urged to give more and charge more. We hope the time will come when we will be able to do so, but that time is not yet.

And now, while fully conscious of our short-comings, we feel gratified to know that we have aided materially in the good work. In conducting the journal, we have endeavored to be fair, and to give all sides as full a hearing as our space would allow, and while not slow to express our own opinions, we have always given a place to opinions of the opposite character when fairly presented. And we have never allowed our personal relations with any one to influence the conduct of the journal.

As we have conducted the journal in the past so we shall carry it on in the future. It has been essentially a journal for the amateur and the working microscopist, and such we intend to keep it.

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Volume I. Out of Print.

WE regret to be obliged to announce that Volume One of the AMERICAN JOURNAL OF MICROSCOPY is out of print, and can no longer be furnished to clubs.

Good News for Diatomists.

ONE of the most valuable papers ever offered to students of the Diatomaceæ, is the "Conspectus" of Prof. H. L. Smith, of Geneva, N. Y. The publication of this was originally commenced in the *Lens*, but was cut short when that journal suspended. We are happy to be able to announce that Prof. Smith is revising this work, and has promised to place the MS. and drawings in our hands at an early day. We propose to issue it at once in book form, instead of as a serial in the Journal, and the price will be made as low as possible—not to exceed one dollar or a dollar and a half. As the price will depend largely on the number of copies that can be sold, and as we desire to make it as low as we consistently can, we would be glad to receive orders for the book from those who desire it. Do not send any money; simply send in your order, so that we may know how many copies will probably be required.

Is He a Scientist?

IN a trial which at present occupies the attention of the scientific world, the following question was put to a prominent witness:

Q.—Don't you regard a scientist as really a scientist until he has published his observations?

And the answer was: No, sir.

Science is, literally, knowledge; thorough, accurate knowledge. And the man who possesses this knowledge, is a scientist, whether he has ever published a line or not. He may not be a scientific *discoverer*, but at the same time, he may have just that accurate knowledge of the discoveries of others which constitutes science. Publication is necessary if a man would substantiate his claim to be regarded as the discoverer of any fact or principle, but, certainly, it is not necessary to entitle a man to the character of a scientist. There are other ways besides the publication of papers by which it may become known that a man has thorough and accurate scientific knowledge.

But without this thorough and accurate scientific knowledge, a man cannot be called a scientist, no matter how extensively he may have appeared in the public journals. Of this, it would be easy to cite what Bacon would have called a "glaring instance," from the testimony in this particular case. But our object is not to be personal, but to correct an impression which may work injury to some of our ablest and most useful workers.

To Our Subscribers.

THIS number of the Journal is sent to all whose names are on our books, whether they have renewed their subscription for 1880 or not. Those who desire to receive the subsequent issues will please notify us, either by forwarding their subscriptions, or at least by postal card, as no numbers will be sent to those who do not signify their desire to receive them.

Amateur Lens Grinding.

SOME articles on this subject which appeared in the *Young Scientist* have greatly interested the readers of that journal, so much so, that the editor feels warranted in giving them more. He therefore announces that he will republish Mr. Wenham's well-known articles giving full directions for making achromatic objectives of really good working qualities. Mr. Wenham's papers will be supplemented by directions from the works of Holtzapffel, Imison, Sir David Brewster, and others, and the whole will be illustrated by engravings of the tools and apparatus employed, and by figures showing the curves of the different lenses and their combinations in objectives of different focal lengths. These articles form the most complete set of directions that have been hitherto published, and who knows but what the impetus thus given to these young amateurs may lead some of them to become a second Spencer or Tolles? As the subscription to the *Young Scientist* is only fifty cents a year, these papers will be placed within the reach of every one that is interested in the subject.

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Determination of the Personal Identity of Skeletons.

In a lecture on the determination of the personal identity of the living and dead, a writer in the *Medical Record* says:

When the question of identity relates to the skeleton merely, or to portions thereof, the answers cannot always be so satisfactory; and the medical jurist has need of much caution and reserve before giving a positive opinion.

The very first thing for him to determine is whether the bones submitted to his inspection are human, or do they belong to some of the lower animals. Certainly, if the entire skeleton is discovered, there need be no doubt whatever on the subject; but if only a single bone or two be found, a mistake may easily be made, except by a practiced anatomist. Indeed, some ludicrous blunders are recorded of persons of education mistaking the bones of the ox, horse, dog, pig, and goat for those of the human subject.

But you will no doubt ask, will not chemistry and microscopy assist in such an instance? As regards the former science, I can at once and positively answer, no. The bone of man has precisely the same chemical elements as that of any other animal. The microscope does throw a little light upon the subject. The bone-cells, or corpuscles, are of different sizes in the various orders of animals. They are largest in the reptiles, and smallest in the birds. There is a striking analogy between the size of the bone corpuscles and that of the red blood-corpuscles among animals. The red blood-corpuscles of the reptiles are largest, and those of the birds smallest. The bone-cells of mammals occupy an intermediate position. The bone-cells of fishes are altogether different from those of all other animals. But having had this much assistance, the microscope cannot distinguish the bone-cell of a man from that of any other mammal, for the bone-cells of the mouse, of the elephant, and of man are all alike; hence you see that the knowledge which the microscope gives us here is not of so much value after all.

Current Notes.

Specimens Wanted.—Dr. Seiler is at present engaged in the study of the normal and pathological histology of the larynx, and begs the favor of the medical profession to send him all the larynxes obtainable from *post-mortems*. Specimens may be sent by express, packed in sawdust, moistened with strong alcohol. Address Dr. C. Seiler, 1,608 Pine Street, Philadelphia.

A Little Book has been sent to each practising physician and Surgeon in the United States, whose name and address are known to the Census Office, with the request that each will keep therein a record of all deaths occurring within his practice during the year June 1, 1879, to May 31, 1880, and will return the register at the close of the year to the Census Office. It is hoped that this effort to improve the Vital Statistics of the United States will meet with general approbation, and receive the countenance and support of the profession.

Distinction between Benzin and Benzol.—The following comparative table of characteristic properties, constructed by Mr. Alf. H. Allen, may serve as an addition to the remarks made by us in an article on this subject on p. 90 of our preceding volume.

Petroleum Spirit, "benzoline," or "benzine."

1. Consists of *heptane*, $C_7 H_{16}$, and its homologues.
2. Heptane contains 84.0 per cent. of carbon.
3. Burns with a somewhat smoky flame.
4. Commences to boil at 54° to 60° C.
5. Specific gravity about .69 to .72.
6. Smells of petroleum.
7. Dissolves iodine, forming a solution of a raspberry-red color.
8. Does not sensibly dissolve pitch, and is scarcely colored by it, even on prolonged contact.
9. When shaken in the cold with one-third of its volume of fused crystals of absolute carbolic acid, the latter remains undissolved.
10. Requires two volumes of absolute alcohol, or four or five volumes of methylated spirit of .828 specific gravity for complete solution at the ordinary temperature.

Coal-Tar Naphtha, or "benzol."

1. Consists of *benzine*, C_6H_6, and its homologues.
2. Contains 92.3 per cent. of carbon.
3. Burns with a very smoky flame.
4. Commences to boil at about 80° C.
5. Specific gravity about .88.
6. Smells of coal-tar.
7. Dissolves iodine, forming a liquid having the color of a solution of potassium permanganate.
8. Readily dissolves pitch, forming a deep-brown solution.
9. Miscible with absolute carbolic acid in all proportions.
10. Miscible with absolute alcohol in all proportions. Forms a homogeneous liquid with an equal measure of methylated spirit of .828 specific gravity.—*The Analyst*, No. 43.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

San Francisco Microscopical Society.—The Seventh Annual Reception of the San Francisco Microscopical Society, was held Friday evening, Dec. 19th, at Mercantile Library Hall. Owing to the inclement weather a number of the exhibitors who reside outside of the city were unable to be present. The attendance, however, was good. The members of the society exhibited the various subjects upon tables arranged around the room. Many of the subjects were very interesting and were particularly well displayed under the costly and beautiful instruments. A list of the exhibitors present and the subjects asigned them is herewith presented:

William Ashburner, diatoms from Santa Monica, diatoms from Nikjobing, Jutland, Denmark, diatoms from Richmond, Virginia.

Charles W. Banks, section leaf of water lily *(Nymphea odorata)* double stained, section of rootlet of date palm *(Phœnix dactylifera)* double stained, section of stem *Bignonia Chamberlanyii.*

Rev. J. L. Bleasdale, D. D., trachea of silk-worm.

Charles H. Denison, zircons with gold, gold crystals, azurite crystals.

Henry G. Hanks, salts crystalized from a baby's tear, counterfeit trade dollar, white sugar.

W. G. W. Harford, pollen of *Pinus tuberculata;* pollen of *Cupressus macrocarpa;* pollen of *Equisetum.*

F. A. Holman, M. D., pigment cells in tail of prawn; kidney of sheep, injected; stomach of frog.

J. A. Langstroth, "Our Mutual Friend"—the flea, alive and kicking; wing of moth; insect scales.

S. M. Mouser, M. D., circulation of blood in mesentery of a living frog.

G. L. Murdock, crystalized cinnabar crystalized gold—native; crystallized gold—artificial.

Warren F. Myers, witch hazel, sections; black walnut, sections; petrified wood, fiber.

E. H. Woolsey, M. D., liver and spinal cord of cat; cornea of frog; human skin.

Microscopical Society of Camden, N. J.—This Society, organized in Nov. 1878, is one of the most prosperous of any established in the past few years. Originally composed of eighteen gentlemen, the most of whom have been patient workers with the microscope, for their individual improvement, for years, has steadily grown without effort to a membership of forty-five, and among them men whose names are quoted as authority in various departments of science. For a time, the meetings were held at the residences of the members, but as its numbers increased, it became necessary to obtain a room suitable for the purpose, which was secured, and suitably furnished to accommodate the members and their friends. As soon as that was accomplished, contributions of Cabinets, of Minerals, and an elegant Herbarium, containing an admirably arranged collection of the Flora of the Middle States, and others with the nucleus of a fine ornithological collection were offered the Society and gratefully accepted. Pictures of distinguished scientists also adorn the walls of the room, which, with the handsome cases and their contents give ample evidence of the approbation with which the movement was received.

The regular meetings of the Society are held on the first Thursday of the month. The third Thursday being devoted to scientific lectures, illustrated when necessary by the gas microscope, to which the citizens of Camden gladly come.

The apparatus of the Society is represented by twenty instruments, more or less costly, comprising instruments of our best makers, Zentmayer, Crouch, Beck, Browning, etc., furnished with all the modern appliances and accessories. In May last, the Society gave a public reception or microscopical soiree, and have participated heartily in several given by the Academy of Natural Sciences in Philadelphia, and elsewhere, the objects shown being mainly preparations by the exhibitors, in which not a few have become so proficient as to challenge the commendation of professional mounters.

The officers of the Society for 1880 are: President, Albert P. Brown, Ph. D.; Secretary, Joseph L. De La Coeur; Treasurer, Louis T. Derousse.

New Jersey State Microscopical Society.—This Society met at Rutger's College, New Brunswick, Nov. 17, 1879. The attendance was large. Officers were elected for the year: President, Prof. F. C. Van Dyck; Vice President, D. C. English, M.D.; Corresponding Secretary, C. H. Voorhees, M.D.; Recording Secretary, and Treasurer, Rev. Samuel Lockwood, Ph D., of Freehold, N. J. The interesting feature of the evening was an able paper by Prof. Geo. Macloskie of Princeton, on the Proboscis of the Blow-Fly, *Musca vomitoria.* 1, Its Structure; 2, Its Functions; 3, Its Homologies. The points made, were:

1st. The teeth of the house-fly, *M. domestica,* differ from those of the blow-fly *M. vomitoria,* in being few, about five in a row on each side of the mouth, and they are three-cusped, while those of the blow-fly are many, about five in a row, and three rows on each side of the mouth, and they are two-cusped.

2nd. The operculum of the house-fly, with its long tendons, represents the mandibles of other insects, coalsced, and probably including the labrum; hence, the middle segment is the true organic base of the mouth parts.

3rd. The fulcrum at the base of the proboscis, represents homologically, the endocranium of other insect orders, which here is free at one end, and hinged at the other to the front of the cranium, and is thus evertible as a pedestal for the proboscis.

4th. The proboscis of the house-fly is protruded mainly by inflation. This view, once proposed by Gleichen, is here revived.

5th. The use of the great tendons of the operculum, is to move the tip of the proboscis from side to side.

6th. The plate is the front part of the interior of the lobster's cephalo-thorax, (described at foot of page 274, "Huxley's Anatomy of the Invertebrates," American edition,) and is the homologue of the endocranium of insects.

The Secretary offered some remarks on the generic value of the teeth of the two flies, as described by the professor, and compared their significance, on the points of number, form, and position, with that of the lingual ribbons of the mollusca.

Mr. L. H. Noe showed a fine resolution of the transverse striæ of *Nitzschia curvula*, being No. 19 of Möller's Probe-Platte, under a dry 1-12 objective, and a 1-inch eye-piece.

The Secretary, Dr. Lockwood, exhibited live specimens, obtained that day by Dr. Stokes, from a tank at Trenton, of the brine-shrimp, which the Secretary determined as *Artemia gracilis*, Verrill. The doctor also showed crystals of Margarine, which he had obtained from a human gall-stone.

The Society met again Dec. 18th, but the evening was chiefly occupied with the discussion and adoption of the new constitution.

S. Lockwood, Sec.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. Exchanges only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Exquisite wild seeds, neatly mounted, in sets, by genera and species. Also pollens in balsam, arranged in same way. Rev. J. T. Brownell, Lyons, N. Y.

Wanted, a three-inch objective, first-class, in exchange for a Zentmayer Erector, unused and perfect, and cash. Rev. C. Van Norden, St. Albans, Vt.

To mounters: Large quantities of pure foraminifera, etc., for first class prepared American material; send samples to J. Green, The Cross, March, England.

Wanted, tertiary and cretaceous fossils, southern or tropical, marine or land shells and rare minerals, for Devonian, Silurian and coal measure fossils, or N. Y. L. and F. W. shells, Mississippi River, Uniondale or Eastern minerals. B. H. Wright, Penn Yan, N. Y.

Slides of pine pollen, so-called sulphur shower, which fell in eastern Pennsylvania, March 17. Diatoms, vegetable stainings, etc., in exchange. C. Henry Kain, 524 Cooper street, Camden, N. J.

Stained vegetable tissue, and polariscope objects, to exchange for any other mounted objects. A. P. Brown, P. O. Box 15, Camden, N. J.

Diatoms, Isthmia enervis, Campylodiscus clypeus, both pure; best Jutland cement-stein, etc. Wanted, good recent Pacific coast material. Correspondence invited. W. M. Paterson, Loftus, England.

Ferns, mounted or unmounted, for Northern species of same. Lists of those on hand and those wanted sent on application. Maj. R. H. Wildberger, Kentucky Military Institute, Farmdale, Ky.

Wanted, well mounted slides, in exchange for a German student lamp. Address H. Watson, 31 Aborn St., Providence, R. I.

A fine Liston's amputating knife, cutting blade 9½ inches, made by Hernstein, in perfect order, to exchange for a good Valentin knife. W. W. Munson, Otisco, N. Y.

Will exchange for well-mounted objects, human teeth sections from any part of tooth desired. H. A. Moyer, Kendallville, Ind.

Wanted, a good stage micrometer, in exchange for fine diatoms and other desirable material. M. A. Booth, Longmeadow, Mass.

Wanted, an achromatic condenser and fitting. or Wenham's parabolic reflector, in exchange for books on medicine, or state what is wanted, H. V. H., P. O. Box 47, Coeymans, Albany Co., N. Y.

PUBLISHERS' DEPARTMENT.

Microscopes at the Exhibition of the American Institute.

At the recent fair of the American Institute, amongst other optical goods there were two microscopes which deserve special notice. One of these was the New Working Microscope, recently brought out by Mr. George Wale; the other was the superb, first-class, binocular instrument made by Mr. Bulloch, of Chicago, for the editor of this journal. To these microscopes the highest premiums ever awarded to this class of exhibits were given, and they well deserve it.

To those who are unfamiliar with the rules which govern the awards by the American Institute, it may be well to say that the competition, so far as the decision in regard to merit is concerned, is not confined merely to the instruments present at any fair. The judges are not only permitted, but directed, to take into consideration all other instruments of like character that may be known to them, so that each exhibition of the American Institute is, in reality, a sort of World's Fair, in which each exhibit is pitted against everything of the kind that may be known to the judges. The judges in this case were the well-known microscopists, Prof. T. d'Oremieulx, Mr. W. Dean, and Dr. McGregor, all prominent members of the

American Microscopical Society, and the following is a copy of their reports:

Extract from the Report of the Judges in Department I, Group 7, at the 48th Exhibition of the American Institute, 1879.

"No. 249. Microscope, by George Wale, Paterson, N. J.

"The 'New Working Microscope,' exhibited by Mr. George Wale, is one of the most perfect, if not the most perfect moderate-sized instrument produced, for the low price at which it sells, by any optician to this day. With the accessories belonging to it, including objectives, the student of nature can carry on his most minute, serious, and important studies. The movements of its various parts are most ingeniously contrived to accomplish every purpose of study.

"Let us say, that the workmanship is unexceptionable.

"We consider this exhibit important and excellent, and would propose that a Medal of Excellence be awarded to Mr. George Wale.

"The Medal of Excellence awarded.

(Signed.) CHAS. WAGER HULL,
Genl. Supt."

"No. 267. Microscope, by Wm. H. Bulloch, Chicago, Ills.

"Mr. Wm. H. Bulloch, in his first-class, large size, binocular microscope, while reproducing a general construction adopted for many years past by some other opticians, has, nevertheless, introduced in his instrument some improvements which deserve attention.

"Amongst others, we may mention a graduated cylinder bearing the mirror bar and recording the angle of illumination, enabling, also, the worker to ascertain the angular aperture of his objectives.

"The instrument is, moreover, remarkable for its excellent workmanship and the fine finish in all its parts.

"We consider this exhibit of great value and decided superiority, and propose that, accordingly, a medal of that grade be awarded Mr. Wm. H. Bulloch.

"The Medal of Superiority awarded.

(Signed.) CHAS. WAGER HULL,
Genl. Supt."

The microscope by Mr. Bulloch deserves more than a passing notice. It is one of his largest and most complete instruments, and embodies all the improvements that have been recently suggested, including the side graduation with vernier, devised independently by several microscopists, and first published by Dr. Blackham.

The mirror bar and the sub-stage bar are swung separately on an axis, the plane of which nearly coincides with the plane in which the object lies. The stage is very thin for a microscope of this kind, and has mechanical movements which may be adjusted so as to work with very great accuracy and delicacy. It also has the graduated finder, devised, we believe, by the late Prof. Bailey, of West Point, and since then adopted by most makers.

A special feature of this instrument is that every movement of importance is capable of accurate adjustment, and does not depend merely upon the excellence of the original workmanship. Every engineer and every astronomer knows that no instrument, no matter how well made, can be expected to remain in accurate adjustment. In the instruments used by them, therefore, special provision is made for readjusting every part, and compensating for those irregularities which are sure to be introduced by we and by change of temperature. In the micr scope under consideration, Mr. Bullock h carried out this idea very fully, so that for an I *strument de precision*, as the French call it, th microscope has no superior that we know of.

Those who desire to examine this superb pie of workmanship can do so at our office.

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Good Wine.

WHATEVER differences of opinion may be ente tained in regard to the use of wine at all, either a beverage or for medical purposes, no one ca doubt that if any wine is used it ought to be goo that is to say, pure and of a good kind. Pu wines are exceedingly difficult to get. It is tru that the common talk about most wines bein a vile compound of logwood, sugar of lead, su phuric acid, etc., etc., merely shows the ignoran of those who deal in such assertions, and wh in general, bring together articles which n chemists could keep in a liquid form. In gener the wines which are palmed off as of superi quality, are compounded from coarse, highl colored, cheap wines, which are softened wit water, strengthened with alcohol, mellowed wit gum, sweetened with sugar, and acidified wit some cheap vegetable acid. Such wines are no *poisonous*, but they produce none of the bene ficial effects of really good wine, and to this exten they are pernicious, especially when used fo medicinal purposes. Many of these factitiou wines have somewhat the flavor of the genuin but it is faint compared with the original, for i often happens that out of a single cask of reall good wine a dealer will manufacture from thr to seven casks of imitation wine, which is sold fo the genuine, and if any question is asked th excuse is that "flavors and bouquets vary so muc with different vintages."

The only way by which those who are not ex perts may assure themselves of the character o the wine they use, is by dealing directly with im porters of intelligence and reputation.

For medical purposes few wines equal the cele brated Hungarian wines—Tokayer Ausbruch Tokayer Maslas, and Budai Imp. We recentl received from Mr. L. Reich, of 13 West 11th Stree N. Y., a sample of his wines, and found them o most superior quality. Mr. Reich has faciliti for procuring from Hungary, direct, the very be growths, and as he does not deal through middle men those who need a really first-class wine o whose excellence and purity they are moral certain, would do well to address him and obtai his catalogue and samples. Those who have no been familiar with wines of this class will b astonished at the superior qualities of these Hungarian wines.

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The Circulation of the Blood

has been demonstrated by the microscope, an the proof of the circulation of Esterbrook's Pe is that they are found everywhere.

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On Stained Sections of Animal Tissues, and How to Prepare Them.*

BY J. W. GROVES.

THE staining of tissues by the more simple tingeing agents, as carmine, logwood, and the aniline dyes, etc., is so easy, that it has always been a matter of marvel to me, that of the thousands of slides one sees (I refer now only to those of stained animal preparations), scarcely any are ever stained so as to show the structures to their best advantage; indeed, most of them are utterly useless.

The causes of this failure in producing good and useful stains are several, and in many cases may be due even to the condition of the material when it first comes into our hands; therefore, though this paper is nominally devoted to stains and staining, I shall treat of

1. Material.
2. Methods of preserving and of hardening it.
3. Cutting of the sections.
4. Tingeing agents.
5. Method of staining: and
6. Suggest a few points to which sufficient attention is not generally given in the mounting of the sections, after all the other processes have been satisfactorily completed.

The Material.

This, in all cases, should be as fresh as possible, and I am confident that much of the want of success in staining is due, not so much to inattention to the details of the staining process itself, as to a want of care in having the material quite fresh.

It should always be borne in mind that, though for the knowledge of human histology it is advisable to study it from tissues obtained from the human subject, still it is so difficult to procure these in good condition—to many people even an impossibility—that for general purposes it is far better to utilize similar structures or organs from the lower animals. Though these may differ in some more or less important details, they do in the main furnish all that for ordinary purposes we require to know of the similar structures in man.

Decomposition rapidly sets in, sufficiently to impair if not to neutralize the subsequent process; therefore, except with certain morbid structures which can only be obtained from the post-mortem room, all normal material, and where possible that also which is morbid, should be placed in a preservative fluid, there to be hardened or softened, as the case may be, either directly after the death of the animal or immediately after its removal from the living body.

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* Read before the Quekett Microscopical Club, May 23rd, 1879.

Preservatives.

These may be divided into two classes—1st, those which simply prevent further alteration, and 2nd, those which, in addition to preserving, at the same time cause hardening, softening, etc., as set forth in the following table:—

1. Simple Preservatives.		Canada Balsam. Glycerine. Goadby's Fluid. Dammar Solution. Glycerine and Carbolic Acid (15·1.) Glycerine Jelly, etc.
2. Those which also harden.	*a.* Simply	Alcohol. Chromic Acid (1-eighth per cent. soln.) Bichromate of Potash (2 per cent. soln.) " Ammonia (ditto,) Muller's Fluid, etc.
	b. Which color also.	Picric Acid (sat. soln.) Osmic Acid (1-2 p.c. soln,) Gold Chloride (½ p.c. soln.) Alcohol and Carmine, etc. Chromic Acid (1-eighth p.c. soln.) and subsequent immersion in glycerine.
3. Those which also soften.		For Mineral Salts—Acids. " Animal Matters—Alkalis.
4. Those which harden some parts and soften others at the same time.		Chromic Acid Solution and Nitric Acid.

In the preceding table are enumerated the more ordinary and useful preservatives, each of which will be presently noticed separately; though, firstly, I wish to draw your attention to three facts in connection with them, which are of the greatest importance, and to the want of a due regard to which may be ascribed a second cause of failure in procuring good stains, to say nothing of their also being the cause of want of success in cutting thin sections.

These facts are, 1st, that it is necessary to be careful to employ that strength of the hardening or softening fluid which is most suitable for the tissues to be acted upon. What these strengths should be it would be impossible to tell for every case, but I will give those which are most usually employed, and for further details must refer you to that useful work, "Practical Histology," by Mr. E. A. Schäfer.

The second fact is, that small pieces of material and a large bulk of the fluid must always be employed; say half a pint of fluid for pieces equal to one cubic inch.

The third fact is, that the fluid (even though that may be alcohol), should be changed frequently. How frequently this change should be made, can only be learned by experience, but for all aqueous solutions it is well to make the first change after a few hours, then every day or two.

Of the hardening agents, chromic acid comes first. This should be used in solutions of various strengths, but provided they are frequently changed it is better to err on the side of their being *too weak* than *too strong*, for in the latter case, the tissues become friable, and crumble away before the knife or razor; besides, it is utterly impossible to stain them properly.

The most useful strengths are ⅛ or ¼ per cent. aqueous solutions, but before immersing the material in these, it is well to place it in a 2 per cent. solution of bichromate of potash or bichromate of ammonia, for some eight or twelve hours, as they have a greater penetrative power than the simple chromic acid solution, and thus cause the masses to be more evenly hardened. It should be remembered that chromic acid solutions have a tendency to bleach tissues already stained or injected with carmine solutions.

Bichromate of potash and bichromate

of ammonia. Either of these may be used in a 2 per cent. solution; the latter being the more generally useful.*

Alcohol. This is perhaps the most generally useful fluid for those who have not much time to devote to the subject, as with it there is less chance of the material spoiling; moreover, tissues hardened by its means, give the best results with most of the staining fluids. Alcohol should be used rather weak at first, then stronger, till the material is hard enough to cut; except when the freezing microtome is to be employed.

Müller's solution is another most useful hardening agent, especially for the retina and other nerve structures. Material should be kept in it from three to six weeks. Its composition is—

Bichromate of potash, 25 grams., or 2½ parts.

Sulphate of sodium, 10 grams., or 1 part.

Water, 1,000 c.c., 100. parts.

The methods of hardening tissues by drying them is open to many objections, among which may be mentioned the alteration of structures and the difficulty of obtaining thin sections; for, cut them as thin as may be, they will swell when rendered moist again by the subsequent processes.

Softening fluids are usually only required for structures which are naturally hard, due to the impregnation of lime salts, as bone and teeth. For these, acids are required, but as it is generally desirable to retain *in situ* the soft parts connected with them, it is advisable to use, as a softener of the inorganic matter, some fluid which will at the same time harden all the soft or organic parts. For this purpose a fluid consisting of

Chromic acid, 1 grm.,

Nitric acid, 2 c.c. (this added last),

Water, 200 c.c.,

is, perhaps, the best. In making it, care should be taken that the chromic acid and water be first mixed, and the nitric acid added subsequently. It is better to immerse specimens containing lime salts in a one-eighth per cent. aqueous solution of chromic acid, or a two per cent. sol. of Pot. Bichrom. for a few days before placing them in this mixture, as by that means the soft parts become more perfectly hardened. A few agents, at the same time that they harden, impart a color to the tissues; thus material which has been soaked in chromic acid acquires a green tinge when placed in glycerine. This, though handy for certain purposes, is not generally useful.

Osmic acid, on the other hand, hardens, and, at the same time, imparts a useful *color*, for it selects all fatty matters and tinges them black. After the material has been partially hardened in a one-tenth to one per cent. aqueous solution of this acid, the process may be completed in alcohol, though if left in acid solution for 12 to 48 hours it will be quite hard enough. When hard it should be placed in distilled water for a day or two, and the sections should be mounted in a saturated solution of acetate of potash (Schultze).

Gold chloride hardens and stains at the same time, but as its powers of penetration are very small, it is chiefly used as a coloring agent.

Picric acid has considerable properties of hardening tissues, whilst it renders them of a bright primrose yellow, but as it is extremely soluble in both alcohol and water, it wants great care in use if it is desired to retain much of the color.

Ranvier states that a concentrated solution will produce excellent results in 24 hours; neither shrinking nor coagulation of the albumen occurring, lime salts being removed at the same time.

Finally, one of the hardening agents, capable of furnishing better results than any other, is the freezing method which has fallen into disrepute with some, because they have considered it inapplicable to tissues just removed from the animal. When thus applied they have almost invariably failed, not to obtain thin sections (for these can be cut as thin as may be desired), but to manipulate them when cut, as they tear most readily in every subsequent process, and, when finely mounted, it is found that nought is left but the tattered fragments of what should have been a good preparation.

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* Material hardened by immersion in solutions of chromic acid, bichromate of potash, or bichromate of ammonia, should be removed to alcohol at the end of about ten days, or it will become brittle.

The freezing method undoubtedly enables us to put up specimens sooner than any other, but before they are frozen they must be exposed for some few hours (say 5 to 24) to the action of one of the hardening agents already mentioned, so as to partially coagulate the fibrin and albumen, and thus enable the sections to be put through the after processes without injury.

The fresh material should be first placed either in:—*a.* An $\frac{1}{8}$ p.c. aqueous solution of chromic acid. *b.* A 2 p.c. aqueous solution of bichromate of potash. *c.* A 2 p.c. aqueous solution of bichromate of ammonia, or *d.* In alcohol solution for 8 or 12 hours.

It should then be washed in clean water to remove the hardening agent, when it is ready for freezing.

With this it is necessary to pound the ice into small pieces, and to mix it thoroughly with an equal quantity of salt; it is moreover necessary to have a free exit for the dissolved mixture.

With material that has been wholly hardened by chromic acid, alcohol, or some other of the reagents above mentioned, the mass must be embedded in some material for the purpose of supporting the structures, as well as in some cases of affording a wider surface upon which to rest the razor.

For cutting sections by hand the best embedding materials are:—

1. Olive oil and white wax in equal parts; or
2. Cacao butter.

While in machines with hollow cylinders, or for use without any machine, either of those or of elder pith or carrot may be employed.

In cutting sections, by whatever process may be preferred, care should be taken:—

1st. That the razor is in perfect condition, and that its surface be kept thoroughly moist with *water* if the freezing method be adopted, or with *spirit,* when any other mode of hardening is used.

2nd. That *each* section as it is cut be floated into water or spirit, instead of allowing several sections to accumulate on the razor, as they thereby get torn, or otherwise injured.

The next subject we have to consider is that of stains, and how to use them.

The following is a table in which the most useful stains are classified according to their qualities, or method of use:—

A. General stains.		Carmine with excess of Ammonia. Eosin (Dreschfeld). Molybdate of Ammonia. (This requires the action of light.)
B. Selective stains.	Simple. Not requiring action of light	Carmine (Beale's). Borax Carmine (Golding Bird.) Logwood (Golding Bird). Logwood Acid Soln. (Schaefer) Indigo Carmine (Tiersch). Anilin Blue (Heidenhain). Picric Acid.
	Simple. requiring action of light.	Gold Chloride. Silver Nitrate. Osmic Acid. Chloride of Palladium.
	Double.	Molybdate of Ammonia and Carmine. Picro Carmine (Schaefer). Chloride of Palladium and Carmine. Carmine and Indigo Carmine. Logwood and Anilin Blue. Gold Chloride and Logwood. Silver Nitrate and Logwood. Silver Nitrate and Gold Chloride.
C. Which will stain in the mass and harden at the same time.		Osmic Acid. Picric Acid. Gold Chloride. Alcohol + Borax Carmine. Alcohol + Golding Bird's Logwood. Alcohol + Eosin.

With regard to these, I will give some general rules applicable to most, and then proceed to notice each separately.

In staining, it is a general rule of almost universal application that the fluid should be weak and the quantity large in proportion to the number of sections, or to the mass, as the case may be.

A section which has been in a fluid so weak that 24 or 48 hours, or even more, have been required to produce the requisite depth of color is almost always better stained than one which has been in fluid which will produce the same tint in a shorter time, for the following reason: that a fluid commences to stain a tissue directly it comes in contact with it. Now from this it follows that the surfaces of the section are stained much sooner, and consequently more deeply than the intervening portions; and if the fluid is strong, this difference will be great.

Again, to produce the best results, the sections should be as thin as possible.

a. Because they take the stain more perfectly.

b. Because the thinner they are the less thickness of colored structures the light has to penetrate before reaching the lenses of the objective; besides, it enables the deeper structures to be more readily examined with high powers.

Those colors are preferable which are cool and pleasant to the eye—*i.e.*, those which contain least red and yellow.

Provided the staining is perfect, and sufficient to show all the detail of which it is capable, the paler it is the better.

a. Because in the examination with the microscope less light is required, and consequently a continuous protracted observation is less fatiguing to the sight.

b. The eye is not so immediately attracted by points and streaks of bright color, thereby running the risk of passing over unnoticed, details of structure of equal importance, but which do not obtrude themselves before us with the same glaring pertinacity.

Finally, it may be remarked that it is better to use distilled in preference to ordinary water in all processes connected with staining. With some—as Logwood, Gold Chloride, and Silver Nitrate—this is of the utmost importance.

Those stains which color all tissues alike are of little use unless employed as a ground to bring out details which would be left untouched by a selective stain, which can afterwards be used, and then their value cannot be overrated.

Thus molybdate of Ammonia produces a most delightfully cool blue-grey general stain, which in no way interferes with the subsequent use of carmine, when all the nuclei appear pink on a pleasant neutral tint ground.

To obtain this a five per cent. neutral aqueous solution of the molybdate should be used. The stain is complete in 24 hours, at an ordinary temperature and under the action of light.

Specimens thus colored become brown by supplementary exposure to the action of tannic acid (1-15) or pyrogallic acid (20 per cent).

Another general stain is a strongly ammoniacal solution of carmine, but this is of little use, and is best avoided.

Eosin, again, is a general stain, which may be used either before or after the sections have been colored with logwood. One part of eosin should be used with 1,000 of water.

Many of the other stains, too, which are themselves selective, may be used with others which have a still stronger selective power, and thus for the time appear to be merely general stains. In this way may be used—

Carmine and Logwood,
Carmine and Silver Nitrate,
Logwood and Silver Nitrate,
Logwood and Gold Chloride,
And some others.

Selective Stains.

Of these none is more useful or more pleasant to work with than logwood; but it is not so commonly used as carmine, because many find it difficult to prepare, and others, from want of success in its use, in consequence, I fancy, of hardening their material in fluids containing chromic acid or bichromates of too great strength.

There are two useful formulæ for the preparation of logwood solutions—

1. Kleinenberg's modified by Golding Bird is easy to use, while the older it is the better are the results obtained with it. It is prepared thus:—

1. Make Saturated Solutions of Alum and Calcium Chloride, in proof spirit.

2. Mix in the proportions of eight of the former to one of the latter.

3. Pound a small piece of Ext. Hœmatoxyli (the older the better); add to it the mixed solution, and agitate.

4. After two days decant, when it may be used at once, though better after keeping.

A watch glass should be filled with water, and a few drops of this solution added, till the fluid acquires a mauve tint. Into this the sections may be placed, and should remain for 24 hours or more.

The second is Schäfer's Acid Logwood Solution, which is especially useful for certain structures, as tendon cells, etc., which could not be so well shown by neutral or alkaline solutions. It is thus prepared:—

A one per cent. Solution of Acetic Acid is colored by the addition of 1·3 of its volume of Logwood Solution.

The Anilin Dyes, whether in aqueous or alcoholic solution, give good results. The best are:—

Roseanilin or Magenta 1 grain, to ounce of Alcohol, red.

Acetate of Mauvein 4 grains, Alcohol 1 ounce, Nitric acid, 1 minim, blue.

Anilin Black 2 grains, Water 1 ounce, grey black.

Nicholson's Soluble Blue 1-6 grain, Alcohol 1 ounce, Nitric Acid 2 minims, blue.

These, as other stains, should be used weak; but the chief point to be careful about is, that after the sections are stained they should be passed through alcohol and oil of cloves as rapidly as possible, otherwise the color will be dissolved out before they reach the balsam.

Heidenhain, in speaking of the use of Anilin Dyes, says:—"The sections, upon removal from alcohol, should remain for a day in a four per cent, neutral aqueous solution, in a moist place, and then be immediately mounted in glycerine and cemented."

Some of the Anilin Dyes are but sparingly soluble in alcohol, whereas they dissolve readily in water. Their color, as a rule, is increased by acetic acid, but removed by ammonia. There are, however, some exceptions

The use of benzole for cleaning instead of clove oil fixes the colors better. but has a tendency to produce shrinking in some structures.

The indigo carmine solution, introduced by Tiersch, is a good and useful *blue* stain, especially for sections of brain and spinal cord which have been hardened in chromic acid, and it possesses one very convenient quality—viz., that if the sections are too deeply stained, the excess of color may be removed by the action of a saturated solution of oxalic acid in alcohol. This reducing process, however, should not be relied on more than is absolutely necessary. It is prepared thus:—

Oxalic Acid, 1 part.
Distilled Water, 22 to 30.
Indigo Carmine, as much as the solution will take up.

Sections should be immersed in this, diluted with alcohol, from 12 to 48 hours, to produce a good color.

Carmine, first used by Gerlach, is a most useful tingeing agent, and if preparations are not colored too deeply, it is not disagreeable to the eye.

Beale's ammoniacal solution is very good, and so is Golding Bird's borax carmine solution, which possesses considerable powers of penetration, so that small masses (about the size of a pea) may be colored with it before being sectioned; and if it is diluted with six times its bulk of alcohol, they may be hardened at the same time, and will be ready for cutting in about 10 days.

Sections stained with the ammoniacal carmine should be washed, and then put into water slightly acidulated with glacial acetic acid (2 minims to the ounce), so as to fix the carmine.

Beale's fluid is thus prepared:—

Carmine, 10 grains.
Liq. Amm. Fort. 30 minims.
Glycerine, 2 oz.
Distilled Water, 2 oz.
Sp. Vini Rect., ½ oz.

Dissolve the carmine in ammonia, boil for a few seconds, add the water, filter; finally add the glycerine and spirit, and keep in a stoppered bottle. Beale says, "Let the excess of ammonia pass off;" but this is unnecessary, as the excess is very slight.

Beale's stain reduced with eleven times its bulk of water produces good results in from 12 to 48 hours.

The borax carmine is thus prepared:—

1. Carmine, ¼ drachm.
2. Borax, 2 drachms.
3. Distilled Water, 4 oz.

Place 1 and 2 dry in a mortar, and mix; then dissolve in warm water for 24 hours; after which pour off the supernatant fluid, and the solution is ready for use.

The acid carmine fluid of Schweiggerseidel is also useful in some cases, though Schäfer's acid logwood, already noticed, is preferable.

So far we have had to do only with stains that change but little if at all. Those which we now come to, however, *do* change materially—*i.e.*, get rapidly darker and more opaque, till they reach a stage when they are utterly useless. They differ from all the others, with the exception of molybdate of ammonia, in the fact that the action of light is necessary to produce the color.

Nitrate of silver, which was introduced by Recklinghausen, is used in a half per cent. aqueous solution. Specimens to be acted upon should be dipped in distilled water to remove any trace of sodium chloride, and then steeped in the silver solution for some two or three minutes, after which they should be washed in ordinary water till it ceases to turn milky; then placed in glycerine and exposed to the action of light, until they assume a dark brown color, when they may be mounted in glycerine or glycerine jelly.

By means of this stain the endothelial cells of the lymphatics, blood-vessels, etc., and the nodes of Ranvier in medullated nerves, are rendered evident. They may subsequently be stained with logwood, carmine, or chloride of gold.

Many methods have been adopted for staining with gold chloride. I may mention three—Dr. Klein's, Dr. C. Bastian's, and Mr. Schäfer's.

1. Dr. Klein's method for showing the nerves in the cornea is as follows:—Remove the cornea within 15 minutes of death; place it in a half per cent. chloride of gold solution for half an hour to a hour and a half or more; wash in distilled water, and expose to the light for a few days, the water being occasionally changed. Then place in glycerine and distilled water, in the proportion of one to two; subsequently place it in water and brush gently with a sable pencil to remove any precipitate, when it may be mounted in glycerine. The cornea should now be of a grey violet tint.

Dr. Charlton Bastian's method is as follows:—

Place the sections or portions of tissue, in

Gold chloride, 1 part.
Distilled water, 2,000 parts, acidulated with strong hydrochloric acid (drop 1 to water 2½ oz).

Let them remain protected from light for an hour, then remove and place them in acidulated water, half the strength of the above, and then transfer to a watch glass containing equal parts of formic acid, and alcohol (90 p.c). They should be stained in about half-an-hour.

Or, if it is desired to produce the stain more rapidly, use—

Chloride of palladium, 1 part.
Water of palladium, 500 parts.

Where they should remain five or ten minutes; then wash in acidulated water, transfer to the formic acid and alcohol, as before, and mount.

Mr. Schäfer's method is the use of the double chloride of gold and potassium.

1. Place the fresh tissue in bichromate of ammonia (1-2 per cent. in water) solution for fifteen or twenty days.
2. Dip the sections, after being cut, into—

a. Water. 1,000 parts.

b. Double chloride of gold and potassium, 1 part.

3. Wash in—

Acid hydrochloric, 1-2 parts.

Water, 3,000 parts.

4. Then immerse for ten minutes in—

Acid hydrochloric, 1 part.

60 p.c. solution of alcohol, 1,000 parts.

5. Transfer to alcohol absolute.

6. Clear with oil of cloves.

7. Mount in balsam or dammar.

In staining with gold chloride or silver nitrate, Mr. Schäfer has found that if the material, after immersion in these stains be dipped into alcohol, the reduction of the metals is thereby greatly facilitated.

Osmic acid, which was first used by Schultze, is useful for the demonstration of fatty matters, which are thereby colored black; it is also valuable for some nerve preparations, but it is very irritating to the mucous membranes of the experimenter, and should be used with caution.

Specimens should be allowed to remain in a 1-2 per cent. aqueous solution of the acid from a quarter to twenty-four hours, when the stains will be complete; but if it is desired to harden also by its means, they should remain in it for some few days.

Osmic acid does not penetrate deeply, therefore small portions should be selected for its action.

Chloride of palladium, also introduced by Schultze, is used to stain and harden the retina, crystalline lens, etc., and other tissues, but cornified fat and connective tissues remain uncolored.

Dissolve:—

Chloride of palladium, 1 part.

In water of palladium, 1,000 parts.

An ounce of this solution will harden a piece of tissue the size of a bean in two or three days, staining it at the same time a brown or straw color. Specimens may be mounted in glycerine at once, or may be further stained with carmine.

Before proceeding to the double stains, it will be well to mention Schäfers silver nitrate and gelatine solution for demonstrating lung epithelium—

Take of gelatine 10 grms., soak in cold water, dissolve, and add warm water to 100 c.c.

Dissolve a decigramme of nitrate of silver in a little distilled water, and add to the gelatine solution.

Inject this with a glass syringe into the lung until distension is pretty complete. Leave it to rest in a cool place until the gelatine has set; then cut sections as thin as possible, place them on a slide with glycerine, and expose to light until ready for examination.

Of the double stains I will specially notice only those where the double color is produced by a single process. Those in which the one color is first employed, and then the other, I will simply state which is to be used first, as all further particulars have been already given.

Those which are used in a single fluid are—

Picro carmine.

Carmine and Indigo carmine.

Anilin blue and anilin red.

Picro-carmine, which was first employed by Ranvier, has been used and prepared in several ways, but perhaps the best is Schäfer's, viz.:—

1. Add to a saturated solution of Picric Acid in water a strong solution of Carmine in Ammonia to saturation.

2. Evaporate the mixture to one-fifth its bulk over a water bath, allow to cool, filter from deposit and evaporate to dryness, when picro-carmine is left as a crystalline powder of red-ochre color.

Sections should be stained in a 1 per cent. aqueous solution, requiring ten minutes for a good result; they should then be washed with distilled water, and mounted in glycerine. If it be desired to preserve them in balsam, after staining, transfer direct to alcohol methylated, then to absolute alcohol, after which they may be cleared in oil of cloves or benzole, and then mounted.

Carmine and indigo carmine adopted by Merbel, gives a blue and red stain, and is said to be extremely selective.

To prepare the Red Fluid,

Take—Carmine ½ oz.

Borax, 2 drachms.

Water dist., 4 oz.

For the Blue Fluid,

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On Stained Sections of Animal Tissues, and How to Prepare Them.*

BY J. W. GROVES.

THE staining of tissues by the more simple tingeing agents, as carmine, logwood, and the aniline dyes, etc., is so easy, that it has always been a matter of marvel to me, that of the thousands of slides one sees (I refer now only to those of stained animal preparations), scarcely any are ever stained so as to show the structures to their best advantage; indeed, most of them are utterly useless.

The causes of this failure in producing good and useful stains are several, and in many cases may be due even to the condition of the material when it first comes into our hands; therefore, though this paper is nominally devoted to stains and staining, I shall treat of

1. Material.
2. Methods of preserving and of hardening it.
3. Cutting of the sections.
4. Tingeing agents.
5. Method of staining: and
6. Suggest a few points to which sufficient attention is not generally given in the mounting of the sections, after all the other processes have been satisfactorily completed.

The Material.

This, in all cases, should be as fresh as possible, and I am confident that much of the want of success in staining is due, not so much to inattention to the details of the staining process itself, as to a want of care in having the material quite fresh.

It should always be borne in mind that, though for the knowledge of human histology it is advisable to study it from tissues obtained from the human subject, still it is so difficult to procure these in good condition—to many people even an impossibility—that for general purposes it is far better to utilize similar structures or organs from the lower animals. Though these may differ in some more or less important details, they do in the main furnish all that for ordinary purposes we require to know of the similar structures in man.

Decomposition rapidly sets in, sufficiently to impair if not to neutralize the subsequent process; therefore, except with certain morbid structures which can only be obtained from the post-mortem room, all normal material, and where possible that also which is morbid, most useful are balsam, glycerine, and glycerine jelly.

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* Read before the Quekett Microscopical Club, May 23rd, 1879.

Canada balsam should be exposed to heat until it becomes quite brittle, allowed to cool, then it should be dissolved in benzole till as thin as glycerine, and should always be used cold.

Glycerine.—Specimens which have been hardened in chromic acid or bichromates may be mounted in pure glycerine alone, but if they have been hardened in spirit, glycerine and carbolic acid (in the proportion of glycerine 15 parts to carbolic acid 1 part) is better, as it is less refractive and prevents the sections becoming granular.

For carmine stained preparations it is well to add a trace of acetic acid to the glycerine (2 minims to the ounce.)

Glycerine jelly is a good medium, as it offers the advantages of glycerine without the chance of leaking, but it is rather difficult to prepare, and therefore had better be bought.

A jelly composed of glycerine, gelatine, equal parts, is very useful; the glycerine should be warmed, and the gelatine (Nelson's) be allowed to dissolve in it.

Acetate of potash in a saturated solution is used for some preparations, but is liable to leak. The same may be said of Goadby's fluid.

To summarise the whole of this paper:—

1. Let the material be quite fresh.

2. *a.* Take care that the hardening or softening fluid is not too strong.

b. Use a large bulk of fluid in proportion to the material.

c. Change the fluid frequently.

d. If freezing be employed, take care that the specimen is thoroughly frozen.

3. *a.* Always use a sharp razor.

b. Take it with one diagonal sweep through the material.

c. Make the sections as thin as possible, and

d. Remove each one as soon as cut, for if sections accumulate on the knife or razor, they are sure to get torn.

4. *a.* Do not be in a hurry to stain, but

b. Remember that a weak coloring solution permeates the section better, and produces the best results; and

c. That the thinner the section is, the better it will take the stains.

5. *a.* Always use glass slips and covers free from scratches and bubbles, and chemically clean.

b. Never use any but extra thin circular covers, so that the specimens may be used with high powers.

c. Always use cold preservatives, except in the case of glycerine jelly, and never use warmth to hasten the drying of balsam or dammar, but run a ring of cement round the cover.

6. Label the specimens correctly, and keep them on the flat and in the dark.

Pathogenetic Bacteria in Salt-Water Marshes.

BY J. J. FRIEDRICH.

In studying the infusorial life in sweet and salt-water bodies, I was soon struck by the almost general absence of bacteria in stagnant water, pools, marshes, etc. Around carcasses of larger animals they are always found in abundance, but they are confined to a limited area around the putrefying substance; they do not spread through the whole body of water. Knowing the widespread occurrence of bacteria in the atmosphere, I was the more astonished, but failed to find an explanation for this apparently paradoxical fact. Meanwhile, observations in the fall of last year gave me a satisfactory solution of the problem. In the beginning of fall, in the months of September and October, infusorial life is the richest and most variable.

Having exposed to the air glass jars containing plants and samples of water from different localities, I soon found certain jars full of wrigglers, the larvæ of mosquitos (Culex pipiens) bouncing with the greatest velocity through the water, which proved to be almost entirely deprived of infusorial life. In the struggle for existence, the wrigglers consume all the weaker micro-organisms, and the only infusoria surviving the struggle are the largest Hypotrichous ciliata, such as stylonychia, euplotes, etc.

Closer observation revealed small brownish lumps of a velvety appearance, deposited on the surface of the water, and containing a large number of mosquito eggs, which after a few days are transformed into larvæ. As mosquitos breed at an enormous rate, the water is soon swarming with wrigglers. To prevent the destruction of my stock for microscopical examination, I had to cover the jars to exclude mosquitoes.

Septic liquids containing putrid meat and decaying plants, giving off a most terrible stench, were purified after wrigglers developed therein, and feasted upon the myriads of bacteria, flagellata, etc. The liquids became perfectly clear, transparent, and odorless—the bacteria at the same time disappearing entirely. Thus I had found in wrigglers the most important factor for controlling and preventing septic processes. Undoubtedly the wrigglers are substituted in other countries by the larvæ of other insects. The scarcity of bacteria, or septic infusoria in stagnant water is lucidly explained by the abundance of wrigglers—they bearing to each other the relation of cause and effect.

Into the study of the etiology of mycotic diseases enters therefore a new element, viz., the conditions regulating the development of the enemies of pathogenetic infusoria—in particular that of the wrigglers.

The present frequent occurrence of septic infusoria will find an easy explanation in the scarcity of wrigglers, which scarcity was brought on in the following manner. The great and sudden reduction of temperature in the latter part of September caused the destruction of mosquitos, especially the females. Although the cold days were followed immediately by hot weather, only a few struggling individuals were left behind, the principal stock having been killed. A jar with a lively breed of wrigglers in my possession, dates from the beginning of October. Later on, mosquitos ceased to annoy me, and I did not need to protect the jars any longer. This scarcity of wrigglers, combined with an unusual high temperature, so favorable to the development of infusorial life, are sufficient to explain the present frequent occurrence of septic infusoria.

Among the pathogenetic bacteria swarming at present in stagnant waters, I wish to allude in particular to Spirillum undula, generally of much rarer occurrence than the other septic bacteria. As well known, Obermeier described in *Ctblt.*, 1873, No. 10, a micro-organism resembling Spirillum tenui, possessing the same rapid corkscrew-like movement, and living in the blood of patients suffering from recurrent fever. Spirillum undula of comparatively large size is a conspicuous object for microscopical examination, and scarcely fails to be detected if present. The transition from the latent or passive state—which state may be easily procured by exposure to cold—to the active state, is readily observed and produced at will. This interesting phenomenon illustrates fully the appearance and disappearance of certain mycoctic diseases, and their dependence upon cosmic agencies.—*Medical Record.*

Measurement of the Amplification of Optical Instruments.

The following was communicated by M. Govi to the French Academy, and, being printed in their 'Proceedings,'* we have thought that a translation might properly find a place here. Those who may not altogether agree with the views expressed, may still find some interest in the fact of the paper having been accepted by the Academy:—

By amplification is meant the relationship of size between the image and the object. The idea of size, obtained by looking at an image, without actually measuring it, is not in any way precise.

If optical instruments give *real* images only, their magnifying power would be very easily determined, and there could be no dispute as to it. *Virtual* images have, nevertheless, quite as measurable a size as real images, and have, like the latter, a determinate place in space.

We must not, then, gratuitously suppose that the eye constantly refers them *to the distance of distinct vision*, because, first of all, such a distance does not exist for normal eyes, and that, if even it did exist, it would not be of any use for the measurement of the amplification; since each observer, and the same observer every time that he refocusses an image, places it or may place it, at a different distance.

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* 'Comptes Rendus,' vol. lxxxvii. (1878) p. 726.

It is sufficient, to prove this, to make several people focus an image, and examine its distance every time, by means of a *megameter*,[†] a little astronomical telescope with graduated draw-tube and micrometer eye-piece. It is thus found that nearly all the focussings give different distances.

The megameter enables us, besides, to measure, in every case, the actual size of the image, by referring it, by the micrometer eye-piece, to a divided scale looked at directly through the megameter, of which the focus has not been changed. The image once measured, it only remains to divide it by the size of the object in order to have the amplification.

The *camera lucida* and the process of *double vision* ("*double vue*") also give the means of measuring the amplification, because the eye is a pretty good judge of the distance of images, and consequently of their size, when it can compare them to different objects whose place is exactly determined (pencil, paper, divided scale, &c.) In having recourse to these processes of measurement, we recognize that instruments with *virtual* images give all the amplifications possible, from a minimum up to infinity, each corresponding to a different distance of the image.

It is therefore inexact to say that such and such a lens, or microscope, magnifies the image of objects a certain number of times, unless we add at what distance such an image ought to be for the indicated amplification to be realised.

The magnifying power of different instruments could be exactly defined, by measuring for each of them the amplification produced at a fixed distance—a decimetre, for example—because all other amplifications could be deduced from that, with sufficient exactitude, by a simple proportion.

What has led to the supposition that virtual images (in the microscope especially) were constantly referred to the same distance (the distance of distinct vision), is probably the fact that, in spite of the enormous variation of distance and size, which virtual images, given by optical instruments, undergo, they always subtend in the eye nearly the same angle,[*] do not vary sensibly in brilliancy, neither lose nor gain in any of their details, and seem consequently not to move in space. In microscopes of high magnifying power, the tenuity of the pencils of rays which start from every point of the image also contributes to make its position in space uncertain to the eye, since the accommodation is no longer necessary in order to see it tolerably clearly. However, it none the less exists in a definite place in space, where we must go to measure it in order to know the true amplification; and here again the *megameter* can be employed with advantage.—*Jour. Royal Mic. Soc.*

The Siliceous Shelled Bacillariæ or Diatomaceæ.

(Continued from page 52, vol. IV.

VIII.—GENERAL ANATOMY AND PHYSIOLOGY OF THE DIATOMACEÆ.

(b).—Propagation and Increase.

THE increase of the diatoms happens very likely, in a three-fold manner, as in the lower algæ, viz: (1), Through the development of the gonimic substance; (2), Through self-division; and (3), Through a seed or bud-like structure.

The first mode of development, which is easily to be observed in the lower algæ, has not yet been certainly proved in the case of diatoms, though many things are known which point thereto.

The *propagation through self division* is, however, universal. As already observed, it shows itself under the siliceous skin-hull stretching along the length of the individual, while the inner space separates itself into two parts, through the formation of two partition walls, standing close to each other, and the endochrome is also divided lengthwise. This division is either *perfect (divisio perfecta)* when the new formed individuals after full secretion, separate themselves, and each one develops itself freely further, or, it is *imperfect (divisio imperfecta)* when the new formed individuals after their completion, are united to the partition walls, often by the help of the siliceous outside skin, or, through secreted gelatinous substance, as in Fragilaria, Melosira, Diatoma, etc.

[†] See, on the measurement of magnifying powers and the use of the megameter, 'Monitore toscano,' 20 August, 1861; 'Memorie della R. Accademia della Scienze di Torino,' vol. xxiii. pp. 455-465; 'Nuovo Cimento,' vol. xvii. p. 177.

[*] The method employed by astronomers to measure the amplification, gives accurate results, in consequence of the almost absolute invariability of the angle subtended by the image.

From this last method of propagation, follows the uniting of many individuals into a common whole, which is according to the shape of the different bodies, either ribbon-like (Fragilaria), beaded or conferva-like (Melosira), chain-like (Diatoma, Biddulphia, Grammatophora), or fan-shaped, (Synedra, Gomphonema, Rhipidophora, Licmophora).

Seed or bud-like forms (Spermatia), appear among congregated individuals, and prove that the single bodies have a real cell life, like the cells of the lower vegetables, which also change themselves to such forms. These seed or bud formations, had already been observed by me in the year 1830, in Melosira, and also in my Synopsis Diatomearum, Tab. 5, f. 68*, had been figured in *Melosira Orichalcea.* I have not only observed them form anew every year in the same manner, but have also found them in other species of this genus, and I have represented them in Tab. ii, fig. 10 in *Melosira varians*, and in Tab. xxi. fig. 5 b, in *Melosira Salina, β. Concatenata.* They distinguish themselves here through a greater swelling from the remainder of the filament, and are in this, similar to the swollen confervæ cells of the genus Œdogonium among the algæ.

In addition, I have observed seed-like forms in *Schizonema tenue* (Tab. xxiii, f. (2), 2 a) and in several species of the genus Micromega (Tab. xxv. (5) 3*, and (8) 7*, Tab. xxvii, (11) 4. a, Tab. xxviii, 1-2). In the former they appear on the tube, and are similar exactly to the fruit of the Vaucheriæ; in the latter they are found in the substance of the cartilaginous mass, and their formation out of the included naviculeæ, allows itself to be exactly followed through all degrees of development; but, with the exception of *Schizonema tenue*, their development into new individuals has not yet been observed.*

The last named fruit-organs of the higher diatomaceæ are not enclosed by a siliceous shell, but by a gelatinous skin, which can be burned, and is the same material as that which forms the tubes; their contents are kernel-like, similar to algæ seeds, and more will be given concerning them, when treating of the respective genera.

(c).—*Motions of the Diatoms.*

The movements of simple, free diatoms, are always to be observed in the examination of recent, living individuals; these motions continue so long as the bodies are free; but, as soon as they cohere, the motions cease. The movements are slow, but powerful, so that small objects in the way, are pushed aside. The motion is generally in a straight line, though often the little bodies turn, and take other directions. Ehrenberg has given, in the case of some of the large naviculeæ, as the organ of motion, an undivided, fleshy (?) sole-like foot, which spreads far from the central opening, but lies close to the shell, which I, however, could not detect,* after diligent and close examination. Still more remarkable are the quickly moving ciliæ which Ehrenberg has observed and figured in the case of Surirella gemma. I have copied this figure after Ehrenberg in Tab. vii. f. 11 c. Ehrenberg observed this form near Cuxhaven, and he says in his book, "On yet Numerous Still Living Species of Animals of the Chalk-Formation" p. 23, as follows about it. "Instead of a snail, foot formed sole, spreading itself, long fine threads were standing out (which the animal voluntarily, slowly shortened or lengthened, or drew entirely back) where the ribs or cross lines of the frustules met the smooth edge of the same; an animal 1-18th of a line long, had as many as 24 for each side of the two plates, and therefore 96 of such thread-like organs of motion, and also in front, on the broad face, four could be seen. Whether these organs are only superfluous threads (cirri) at the side of a narrow sole, as the other naviculeæ have it, I could not decide. Length openings, and a middle opening on the broad face of the frustule do not exist, but more than six, up to ninety-six openings for the cirri appear visible."*

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* Many since Kutzing have mistaken these for seed germs of the diatoms. The swollen cells of Melosira as represented by Kutzing, and possibly those of Schiz. tenue, are no doubt sporangial; the others are more than doubtful.—*Trans.*

* We may add, and no one else has ever seen.—*Trans.*

After these communications it may now be necessary to enter more closely on the question,

(d).—Are the Diatoms plants or Animals? And to present the reasons for or against the one opinion or the other.

The following statements of Ehrenberg speak for the animal nature.

(1). The diatoms possess, in part, a peculiar, independent movement, which is produced by special organs of motion.

(2). Many diatoms have at the middle in side view (Nebenseite) an opening around which small round bodies arrange themselves, and which, like the stomach-cells of many of the infusoria, are colored blue by indigo diffused in water, and therefore may be taken for stomachs.

(3). The shell of many diatoms reminds one through its structure and formation of the gasteropods and similar molluscs.†

Concerning (1), it is to be remarked that independent motions occur also in the lower plant formations, which are likewise produced by peculiar brush-like organs of motion. I here recollect the excellent observations of Unger on Vaucheria clavata, "The plant at the moment of becoming an animal," Vienna, 1843. He observed brushes on the young Vaucheria germs, which, through their motion, caused a movement of the germs; and again of the very careful and minute observations of Von Flotow (On Haematococcus pluvialis, in the "Nova. Acta Acad. Caes. Leop. Cur. Nat. Cur.," vol. xx., Ser. ii, p. 413-592,) which are closely allied to these objects. Lastly . will mention my own observations, adduced in the Phycologia generalis, concerning Ulothrix Zonata (p. 251,) and other algæ forms, which show that, in all these low organisms, appearances of motion occur which cannot be distinguished from those of infusoria.

Therefore, if we do not wish to transfer a plant to the animal kingdom because it has motions, the animal nature of diatoms is by no means proved.

Concerning (2), I have already remarked regarding the so-called stomach-cells, mentioned above, that a coloring of these parts by indigo is possible, also by mere mechanical attraction. The supposition that they are stomach-sacs, appears hazardous, and the more so as these parts, very often do not exist.

As for (3), the Frustule (Panzer) has in some cases by its structure and markings, a similarity with the shell of the Molluscs, this, however, is not the case throughout, and in the higher families of plants we find cells which in marking, forms, and other relations, present similar appearances.

I only call to mind the manifold forms of pollen, (See Fritzsche on pollen with representations), where also the edges, spines, openings, etc., are not wanting. In this respect, therefore, the approaches of diatoms to decided plant structures are just as great as to those of animals.

On the other hand, the following facts declare for their vegetable nature:

(1). The great similarity of the compound forms to the algæ, and their growth through self-division.

There are, indeed, compound infusoria, e.g., Monad colonies, and those of Polyps, but the former are themselves very questionably animals, and the latter have the *essential difference* that the active animal, in its habitation, lives free towards the outside and moves itself freely, whereas, the Naviculeæ, Encyonemeæ, as also the Schizonemeæ, Micromegeæ and allied genera, grow together in the inner substance; yea, form it themselves, like cells from the stem of a plant, and vegetate exactly like cells. The individuals of Himantidium, Fragilaria, Melosira, etc., are, moreover, united, and incapable of animal motions.

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* It is scarcely necessary to remark that these threads (cirri) seen by Ehrenberg, were fungoid growths, and not organs of locomotion.—*Trans.*

†Other reasons which Ehr. (Poggendorff's Annalen ii., vol. 8. 1836, p. 223.) has adduced besides these, for the animal nature of diatoms (e.g., self division), deserve no further notice, since they were long ago set aside by more recent observations on the lower algæ.

(2). The internal soft organic parts which I have designated as gonimic substance, in their chemical constitution, as also in the relations of their development, possess peculiarities, which are exactly paralleled by the cell-contents of the conferva-like algæ.

This relation shows itself most clearly in the Genus Melosira, and cognate forms, which, not only in structure, but also in the chemical identity of their internal substance, (through the presence of Chlorophyl, occurring, however, in all diatoms), ally themselves closely to conferva formations.

(3). The formation of seed-vessels or fruit, in the mode described above, occurs in like manner, only in decided algæ, never in true animals.

(4). The diatoms, and especially the free moving Naviculeæ, give off in sunshine a notable quantity of oxygen, like all decided plants. The production of oxygen is to be noticed, indeed, in the case of the green Monads, and Euglenæ, but this proves nothing for the animal nature of the diatomaceæ, it rather makes the position of these infusoria as animals a very doubtful one. Really, this comparison speaks more for the vegetable than the animal nature of the diatoms. Inasmuch, however, as there are appearances, even in decided plant formations, which remind one of animal nature, therefore both observation and experience suggest the question, whether there may not be organisms which unite in themselves both an animal and vegetable nature, and approach the one or the other of these two great realms of nature, according to the predominance of the vegetable over the animal, or vice versa ?

We distinguish, as is well known, three great nature kingdoms; the inorganic (with only chemical actions); the vegetable, and the animal; (both with organic life.) We know that inorganic combinations (and therefore substances belonging to the inorganic kingdom), occur in the organic or organized combinations (in plants and animals). We know that inorganic substances are employed for the building up of organic forms, nay, that they are even (as e.g., in the diatoms, siliceous oxide for the formation of the frustule) absolutely necessary. We know also, that when the inorganic (chemical) combinations, obtain the upper hand in an organism, the latter perishes. While it is true that one cannot in such cases, always say that this or that organism was changed into a chemical combination, we can say that by the inorganic substance which developed itself principally in it, it was suppressed, or retired. Now, when such appearances occur between inorganic and organic substances, why should they not also take place between animal and vegetable formations ? Why should not the animal organic substance enter into combination with the vegetable, and form an organism uniting the nature of both, just as phosphate of lime unites with animal gelatine in bone ? Does not the supposition of the association of animal and vegetable substances appear more natural than that of lime, siliceous earth, or heavy metallic oxides, etc., with organic substance ?

For this reason, I think, I have not the slightest cause to change the assertion made some time ago in my "Phycologia," and more recently in a special pamphlet,* and which is likewise supported by the opinions of many eminent men, that there are organisms in which the animal is so united with the vegetable nature, that they can lead now an animal, now a vegetable life, according to the predominant development of the animal or vegetable nature in them, without changing their original form.

According to this view we must accept three different substances in the diatoms, viz:

(1). *A chemical inorganic*, the silica which constitutes the frustule.

(2). *An organic substance with vegetable life*, from which comes, partly the gonimic substance, and partly the slimy and jelly-like formations constituting the structureless and common cover of many Naviculeæ, the tubes of the Schizonemeæ, and the stipes of the adherent forms, (Achnanthes, Gomphonema, etc.)

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* The Sophists and Dialecticians, the greatest enemies of scientific botany. Nordhausen, 1844.

(3). *An organic substance with animal life,* which would be employed in the formation of organs of motion.

From this presentation it appears, that a mutual predominance, and manifestation of the animal or vegetable relations can only occur in the simplest, lower organisms, and that therefore a more complex organism must determine for itself distinct plant or animal life, and so we find decided plants and animals only in the higher grades of development.

All diatoms in their complex forms, appear as decided plant-formations, only the simplest show appearances reminding of the infusoria, in this resembling all lower plant formations, in which the same thing occurs.

The Method of Using Wide-Angled Objectives.

BY GEO. E. BLACKHAM, M.D., F.R.M.S.,

IN response to numerous requests, among them one from the Editor of this Journal, I propose to give briefly in this paper the results of my experience as to the best methods of using objectives of wide-angle.

While I do not at all assume to speak *ex cathedra,* I shall, nevertheless, for the sake of brevity and directness, put my statements in a somewhat dogmatic form.

I may say at once that I recognise the difficulty of giving *any* instructions which shall be of use in reference to the best method of using objectives. Manipulative skill with the microscope is a thing of comparatively slow growth which can only be attained by continuous, careful and intelligent practice, by which the eye, the hand, and the brain, are gradually trained to act in unconscious concert. Practice, and practice only, can give this skill, and without practice, the most intelligent perusal of the most explicit directions can avail but little. On the other hand, it is also true that practice may be so misdirected as to tend rather to confirm one in bad habits, than to lead on to continually increasing manipulative skill. It is by directing practice into the proper channel, that a writer can alone hope to be of use, and it is with this view that I have been induced to snatch from days and nights, overcrowded with business, the time necessary to prepare this paper for publication.

In the first place then, let me begin by saying that the method of using wide-angled objectives is not, as seems to be assumed by many not familiar with them, a thing *sui generis* and apart from the best method of using the microscope in general, nor is it exceedingly abstruse and difficult. Indeed, it may be said, that even for the beginner, if he has any skill with the microscope at all, it is much easier to obtain *as good* results, yes, and *better* results, with wide-angled objectives than with objectives of the same nominal focal length but of narrower aperture.

To obtain the *best* results of which *any* objective is capable, is a matter requiring patient study and long practice, and it will be found that after the best results of which a well made narrow-angled objective is capable have been obtained, the same amount of skill will give better results with a wider angled objective, and that there is beyond this, a field into which the wide-angled objective gives, under still more skilful manipulation, free entry, and from which the narrower angled glass is from its very construction necessarily excluded.

Supposing, then, that a young microscopist has determined to perfect himself in the use of the best modern objectives, what shall he do? There are several important preliminaries to be attended to.

1st. He must have *really* wide-angled lenses. That is, lenses that will not only *admit* and *transmit* a pencil of light of wide angular value, but which can also *utilize* the most oblique rays which they transmit. This is important, because there are many glasses by good makers, in the market, which admit rays far more oblique than they can utilize for the formation of a well defined image, and these outside rays, so far from adding to the value of the glass, are a positive detriment, and should be cut off by appropriate diaphragms. These glasses are usually overrated as to aperture, and this not from any dishonesty on the part of the makers, but from a false and absurd system of measurement, in which the aperture is obtained by converting the objective into a telescope and viewing the *distant* image of a candle flame gradually moved around the periphery of a circle of which the focal point of the objective is the centre. This plan gives (approximately) the angle *for admission of light*, and the objective is honestly, but wrongly, marked accordingly.

If, now, one of these objectives is focused on some appropriate object, and illuminated with a small narrow flame which is then moved around the object as a centre, and the image of the object, not the distant flame, examined with an ordinary eye-piece, it will be found that when a certain degree of obliquity of illumination is reached, the definition begins to fail, but that considerably greater obliquity can be gained before the field becomes darkened, the image of the object having mean time become so distorted, as to be almost or entirely unrecognizable. The point where definition begins to fail indicates the angular *aperture for definition*, or *true aperture* of the lens, and the point where the field becomes darkened the *aperture for admission of light*, or the *false aperture* of the lens. In properly constructed lenses the extreme angle for admission of light and for definition are almost identical, or in other words, the lens does not transmit any rays which it cannot utilize. Such only are entitled to be classed as *first class* objectives, and it is of such lenses, whose angles are wide for their focal length, that I propose to speak.

It may be well here to indicate what are at present, classed as wide angled lenses, viz:—1 inch of 30° and upwards; ½ of 75° and upwards; ¼ of 150° and upwards; all these being air angles, and 1-6, 1-10 etc., of (infinitely near) 180° air angle, or 82° balsam angle and upwards. These last, of course, can only be *immersion* lenses.

2nd. The stand. This is important, because on many costly stands of foreign make, and of first-class construction, so far as workmanship is concerned, it is impossible to obtain the best result from wide-angled objectives.

The stage should be as thin as possible, consistent with sufficient firmness. A thick stage will, of course, prevent much obliquity of illumination direct from the mirror, and while no stage can be made rigid enough to resist entirely the effects of pressure upon it, it must be remembered that no great weight should ever be borne upon it, the weight of the ordinary 3 by 1 slide being very slight, and the pressure of the hand of a skillful microscopist being almost *nil*, hence the massive stages found on many costly stands are not only useless but detrimental. A stage 1-3 of an inch thick at the periphery, and beveled to a knife edge at the well hole in the centre is amply strong for any legitimate service. The stage should, if possible, rotate concentrically with the optic axis of the microscope body.

The mirrors should be both plane and concave, and be capable of movement in almost any direction, and should be hung so as to swing either around the object as a centre, or as nearly so as possible. The *double jointed* arms on which some mirrors are swung, are an unmitigated nuisance, and almost preclude the possibility of properly manipulating the mirror. The concave mirror should be of as large diameter as possible, its surface ground to a true spherical curve of such radius that, by means of a movement to and from the stage, either parallel or divergent rays falling on the mirror may be accurately focused upon the object.

The body of the microscope should be by preference monocular, but if a binocular be used, care must be taken to see that the fittings for the prism do not so reduce the opening as to practically act as a diaphragm and reduce the angle of the objective.

A friend whose attention I called to this point, found that a diaphragm in the nose-piece of his binocular stand did so reduce the effective angles of his new lenses, that he could not obtain first-class results. He had the nose-piece containing the Wenham prism made removable, and when using wide-angled objectives, replaces it with a plain one, having a clear opening, and has since had no trouble.

3d. *The Light.*—A narrow pencil of light directed upon the object at the proper degree of obliquity, gives the best results. The best would be a slender pencil of parallel rays, that is, this would be best for most objects. If the examination is to be by central light, then all oblique rays should be cut off by suitable diaphragms, and if by oblique light, then all rays not of the special degree of obliquity employed should be cut off.

There is no necessity for the use of any of the various forms of achromatic condensers, the best results can be obtained far more easily, cheaply and certainly without them, than with them.

Among their faults, the chief are, that they are never absolutely achromatic, and that they give too wide an angular value to the pencil of light they condense upon the object, and that they are costly.

It is evident that if we are to use so slender a pencil of light it must be of considerable intensity. The direct light of the sun is *too* intense, unless admitted through a pin hole aperture, as in Col. Woodward's original use of his prism. Used in this way, it is the best light possible, unless it be sunlight deprived of most of its heat, and rendered monochromatic by filtration through a cell containing a solution of ammonio-sulphate of copper. *Blue* sunlight thus obtained, by cancelling chromatic error, improves the work of the best objectives, and often enables inferior objectives to resolve tests far beyond their power by any other mode of illumination which I have ever tried. The electric light, the magnesium light, and the various forms of lime light, promise well theoretically, but I have never tried them and they are, for the present, at least, too cumbrous, inconvenient and costly, for ordinary use.

Good daylight is excellent, if admitted into a darkened room through a small aperture, but as ordinarily used, the diffused light in the room is apt to overpower that received through the microscope, and to render fine work by daylight almost impossible.

Of all artificial lights, that of a good kerosene lamp is at once the best and the cheapest.

The lamp should have a *flat* wick—*not* a round one as often recommended,—hence, the student lamp, though powerful and convenient in some ways, is not the best. A common bedroom hand lamp with a plain straight chimney is better; but best of all is the mechanical lamp, in which there is no chimney, to cause aberation of the rays, the draft being supplied by a fan run by clock-work. There are at least two makes in the market, the best, so far as my experience goes, being known as the Hitchcock lamp. This gives a very steady, intense, *white* light, and is altogether the best light I have ever tried for general use with the microscope, being more manageable than daylight, and nearly if not quite, as good in other respects.

When in use the flame may be turned quite low and the *edge* set at right angles to the surface of the mirror, the object being not to obtain a large *quantity* of light, but a *small* pencil of considerable *intensity*. It will often be found useful to cut off a portion of the reflecting surface of the concave mirror by means of masks of *dead* black paper, thus securing smaller angular value for the reflected cone of light.

Now, having secured all these preliminaries, how shall we proceed.

Let us take, first, the case of a low power objective, say a 1 inch of 30°, and an object, say, some of the larger infusoria, in a cell, and begin our examination by central light. Placing the object upon the stage, we turn the wheel of diaphragms so that the largest opening is in the axis, then placing the lamp directly in front or to the left side, we move the mirror till the light falls on the object; then using the concave mirror, we move it to and from the stage till a picture of the light is formed on the object. Then turn the wheel of diaphragms till a smaller one is central, and move it some distance from the stage, this makes the angle of the cone of light, having the aperture in the diaphragm for its base, and the object at its apex, more acute, next turn the plane mirror uppermost, and then put on your objective and lowest eye-piece, and proceed to the examination of the object. If the light is too bright, use a smaller aperture in your wheel of diaphragms, if not bright enough, a larger one. You can then gradually increase the power of your eye-piece, using successively the lowest, (2 inch or A), the 1 inch or B, and so on up to the 1-4 or even 1-6 inch solid, the latter giving a power of 600 diameters, with an inch objective. If your objective is a good one, it will stand it up to the 1-4 inch solid eye-piece without material deterioration of the image, but each time you increase the power of your eye-piece, you should have to increase the illumination of the object, first by using larger and larger apertures in your wheel of diaphragms, and when that plan is exhausted, by reverting to a small aperture and using the concave mirror. I say you *should* have to increase the illumination because if you do not find this necessary, it is evidence that you had too much light in the first place, and this is one of the commonest errors of beginners in microscopy, and, indeed, of older microscopists, who are beginning to use wide-angled lenses, and, who do not take into consideration the fact that the wide-angled lenses, by reason of their wide angles, give a much brighter image with the same illumination than narrow-angled ones.

For oblique light the process is practically the same, except that the lamp should stand to the left of the microscope, so that the mirror can be manipulated with the *right* hand. Of course, if you happen to be left-handed, the lamp should stand on the right.

So much for the method of using lenses of low power and *comparatively* wide angle; now as to immersion lenses of higher power and the widest attainable angles, i. e., 82° balsam, and upwards, 82° *balsam* being equivalent to infinitely near 180° *air.*

Of all immersion media which I have tried, *good* extra heavy pure glycerine is the best. Its index of refraction is much nearer to that of glass than is the case with water, it can be obtained perfectly pure, and it does not dry up. Its index of refraction is nearly as close to that of glass as is the case with the various essential oils, such as oil of cedar, etc., etc., which have been used; it does not smell badly, does not run so freely, and does not dissolve balsam and various cements as oil of cedar does. It is also more easily obtained good, most of the oil of cedar in the market not being suitable for immersion purposes.

We will assume then that, say, an immersion 1-6 of 95° balsam angle is to be used with glycerine immersion, over, let us say, a difficult object mounted in balsam.

The preliminary steps are precisely like those used with the one inch of 30°, except that the front of the lens is immersed in a drop of glycerine, but when we come to use very oblique light, it is well to remove the wheel of diaphragms, and all sub-stage apparatus, except the mirror, and cut off central rays by means of a very simple and inexpensive device known as Smith's V-shaped diaphragm. This was shown to me by Prof. J. E. Smith, now of Cleveland, O., and is, I believe, his invention. It is simply a piece of common ferrotype plate clamped to the under side of the stage, so as to cover the hole in the centre, and leave the edge of the plate towards the mirror free. The free edge can be bent downwards to any desired angle, corresponding to the position of the mirror. With this simple apparatus, and my Tolles' 1-6 of 95° balsam angle, I have frequently gone through the Möller balsam-mounted Probe-Platte, resolving every diatom on it, using light from a common kerosene hand-lamp, reflected from the concave mirror. The stage on my microscope, is, however, specially thin, admitting light up to 80° from the axis. If it is desired to use light more oblique than the stage will admit, some kind of contrivance must be used to cancel the effect of the lower side of the slide, for even if we put the slide on the lower side of the stage, and then send in the most oblique ray possible, that is, nearly 90° from the axis, it will be refracted within the body of the glass slide to about 41° from the axis. Now, if we attach to the underside of the slide, by means of a drop of glycerine, a small prism of glass (commonly known as a Woodward prism) of such angle that one of its faces is at right angles to a ray, say, 45° from the axis, it is evident that that ray falling upon the face of the prism as a normal, will not be refracted, but will pass into the prism and through the thin film of glycerine without sensible refraction, and enter the body of the slide and reach the object at an angle of 45° from the axis, which is greater than the limit of 41° from the axis, to which any ray proceeding from the air directly into the slide, would be refracted.

Still better, if we use in place of the prism, a much older device of Mr. Tolles, that is, a small plano-convex lens, of such thickness that the slide completes the hemisphere, and the object is in the centre of curvature, then any ray proceeding to the object from below will strike the curved surface as a normal, and proceed to the object without refraction, the principle is that of using a prism with an infinite number of surfaces, and by this means we can obtain illumination more oblique than any lens yet made can utilize, about 50° from the axis (in the slide) being the most oblique that will be likely to be of use with most, even of the widest angled objectives yet made.

It will probably be expected that something should be said here in reference to the *adjustment* of the objective for different cover glasses, etc., by means of the screw collar, but on this point, unfortunately, but little can be said, though, of course, it is a most important one, and the better the objective, and the wider its angle, the more important is accurate adjustment. Every wide-angled immersion objective that is worth having, is a separate work of art, and, as such, has an individuality with which the worker must become acquainted, and which he must learn to turn to his advantage.

None of these lenses which I have seen are perfectly achromatic, and each has a special wave length at which it does its best. In Tolles', and Bausch & Lomb's, and I believe in Spencer's lenses, this is between the blue and the green, but the exact shade differs with different lenses, and must be found by experiment. My plan is to adjust roughly by means of the tint of the field, then to bring an object into the field, if we are at work on the probe platte, one of the easier diatoms, say *Pleurosigma Angulatum*, ana focus on it and arrange the illumination as accurately as possible, and then with the finger and thumb of the left hand, turn the correction collar of the objective backwards and forwards, keeping the object in focus all the time by means of the forefinger of the right hand on the milled head of the fine adjustment, until the best effect is obtained. An occasional slight change in the position of the mirror is often needed.

In all these manipulations, deliberation and care are needed, and the patience of the beginner will often be sorely taxed, but let him remember that nothing worth having can be gotten without trouble.

It will often be difficult, even with the very best fine adjustment arrangements, (and still more often with inferior ones), to get the objective in such exact focus as to show to the best advantage, such very difficult objects as, say, the lines on balsam mounted *Amphipleura Pellucida.* The plan then is to get it as near as possible, and then to grasp the curve arm of the microscope, with the finger and thumb, and to exert *light* pressure backwards or forwards on the arm, thus springing it and carrying the body of the microscope with objective and eyepiece, nearer to or farther from the object. It would seem almost impossible to spring the heavy arm of a large microscope enough to do any good, without exerting a dangerous amount of force, but, on trial, it will be found that a very light pressure is ample, and that this is the *finest* of fine adjustments.

A shade of blackened pasteboard, with a hole in it to slip over the upper end of the body of the microscope, will be found useful to protect the eyes from extraneous light.

To sum up, the rules for using the best wide-angled objectives to the best advantage are:

1st. Be sure you have good objectives.

2nd. Be sure your stand is not so constructed as to defeat your objectives.

3rd. Have a good light, intense in quality rather than great in quantity.

4th. Take great care in the arrangement of your mirror.

5th. Use a *narrow beam* of light at just the proper obliquity for the case in hand, and exclude all other light.

6th. Don't drown out your details and damage your eyes by an excess of illumination.

7th. If your objective is adjustable *take time* and adjust it *properly*.

8th. Focus accurately.

9th. Despise not small details.

10th. *Above all don't be in a hurry.*

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A Cheap and Simple Camera for the Microscope.

THE following description of a capital little device has been sent to us by Mr. T. B. Jennings. Any of our readers can make the accessory for themselves. Where the eye-piece is not furnished with a cap, there is generally a milled ring which is larger than the tube of the eye-piece. In this case it may be necessary to wind a narrow strip of paper round the eye-piece so as to make it of equal size for at least a quarter or three-eighths of an inch from the upper end. Mr. Jennings writes:

Probably there is nothing that will assist the student in microscopy so thoroughly as drawing the object, as he thereby *fixes* the different parts in his mind.

A good camera lucida is too expensive for many persons, while other and more necessary accessories are being purchased. Having made a good reflector for my own use at *no* expense, and thinking that many of your subscribers might desire to do the same, I give the mode.

Take a flat cork, Fig 1, *a* (mine was from a large-mouthed bottle), cut a hole, *b*, through its centre large enough to fit over the eye-piece after the cap has been removed. Just below the hole make an incision, *c*, so that it will hold a thin glass cover, *d*, at an angle of 45°. I use a cover ¾ of an inch in diameter.

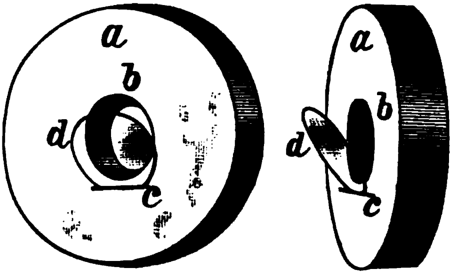

Fig. 1. Fig. 2.

CHEAP CAMERA LUCIDA.

The "reflector" can be easily removed when not in use, and the glass readily taken out to be cleaned. Fig. 2 is a side view.

◆

Microscopical Societies.

WE shall publish at an early day a list of all the Microscopical Societies in the country, with date of organization, list of officers, etc. The secretaries of the different societies will confer a favor upon us and will do good service to the microscopists of the country, if they will send us all the data necessary to give their own society a place in the list. Give name, date of organization, names of officers, days of meeting, and such other facts as may be deemed important.

We shall be glad to receive from the secretaries of the different Societies a report of their transactions. These transactions we publish without note or comment, and in full, unless they contain matter of a purely personal character, which is of no interest to the general reader. No greater service can be rendered to the cause of microscopy in this country than the publication of these transactions.

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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Postponed.

ALTHOUGH we give twenty-eight closely printed pages this month, we are obliged to postpone several important articles, amongst others Prof. Kellicott's paper on *Argulus Stizostethii*. We have, also, an extended notice of recent catologues of Microscope makers, which we have been obliged to hold over.

The Highest Magnifying Power Ever Reached.

ALMOST the first question asked by those to whom a microscope is shown, provided they are not familiar with the instrument in its different forms, is: "How much does it magnify?" and the next question generally is, "What is the highest magnifying power made?" and even to those who have a general knowledge of the subject, the question "What is the highest magnifying power that has ever been reached?" is one of more than usual interest. We propose to tell what we know about the subject, and will be glad to hear from others who have additional facts within their knowledge.

Of simple microscopes, we suppose that those which magnified most, (at least so far as any record exists), were the ones sent by Di Torre, of Naples, to the Royal Society of England. Coddington tells us in his "Optics," that one of them was said to magnify 2,560 diameters, and the maker claimed that he had been successful in using it. But Baker, to whom it was entrusted for examination and report, said that he could do nothing with it, and that several earnest attempts to use it had seriously injured his sight. It is more than likely, that the power to use such small lenses will depend greatly upon the conformation of the eye of the observer, and Di Torre may have had exceptional visual organs.

Of compound microscopes, the highest magnifying power reached, so far as we know, is 100,000 diameters. This was obtained about ten years ago, by Mr. Edward Dickerson of this city, and was publicly exhibited to several of his friends and acquaintances. The New York *Sun* published a long article upon the subject, and described the appearances which ordinary objects, magnified to this degree might be supposed to present. Thus, a single human blood corpuscle, if magnified 100,000 times, would be over thirty inches in diameter, or the size of a small cart wheel. A human hair, seen under such a power, would rival in appearance, the giant trees of California, for it would be over forty feet in diameter. A fly would appear as a monster, three-quarters of a mile long, and the claws of a honey bee, would stretch across our widest streets and clasp the houses on both sides, like huge grappling irons.

This style of writing, which is very common amongst pseudo-scientific writers, conveys entirely erroneous ideas as to the results which could be obtained by such powers. For example, it would be utterly impossible to obtain a complete view of a fly, even with a magnifying power far less than that here described; a small part of one of the facets of the fly's eye, would fill the whole field of view, so that the fly itself would not "appear" at all.

That Mr. Dickerson did obtain a power of this extent, there is, we believe, no doubt, but as may easily be imagined, no results of any value were ever obtained by it. The power was obtained in the old way, carried, however, to extremes. A high objective, (a fifteenth, we believe in this case), a high eye-piece, a long tube, and an amplifier. The furthest it could go in resolving power, was the *P. Angulatum,* and this was resolved into dots. Photographs and models of the *Angulatum* as thus seen were exhibited, but the photographs were not made by the microscope, but were from drawings or models. Descriptions of the wonders that *might* have been exhibited were freely quoted in the daily papers, and the echo of these accounts reverberated through the Scientific press of Europe. But of so little real value were the actual results, that, although all this occurred only ten years ago, it has long since been forgotten.

Of the magnifying powers used by those who have achieved notable results in microscopy, the following deserve notice:

Raspail carried the use of the single microscope as far as it could go, and 150 to 200 diameters was, we believe, the limit of his power. His remarks upon the value of high powers, are interesting and instructive, and we shall recur to them again before long.

The highest recorded magnifying powers procured by means of compound microscopes are, we believe, those which have been used by Dr. Beale. He has employed successfully, a magnifying power of 10,000 diameters, and claims that powers lower than 2,000 to 5,000 diameters are insufficient in many cases. The objectives used by Dr. Beale are a 1-16th, a 1-25th, a 1-50th, and a 1-80th. He uses long draw-tubes (24 inches,) in preference to high eye-pieces, and he does not use an amplifier. It seems to us, however, that where such long tubes are used, the observer should use an amplifier, so formed as to correct the aberrations introduced, unless his objectives have been specially constructed with a view to the employment of such tubes.

In this connection an interesting question arises in regard to the limit of magnifying power that may be obtained with lenses of a given quality. If we wish to use a magnifying power of 10,000 diameters, is it best to use a 1-10th objective, and bring up the power with amplifiers and eye-pieces, or should we use say a 1-25th, with eye-pieces of only one-fourth the power? Another question is: To what extent can we magnify the object when we use second-class objectives? In other words: Suppose we are using a quarter-inch objective, of fair but not first-class quality, can we see more with a power of two thousand diameters, than one of 1,000 diameters? Or, in other words:

With what power can we see most of the fine details of an object, one of two thousand diameters, or, one of one thousand diameters? Will the increase beyond one thousand diameters result in such deterioration of definition as will more than make up for the increased amplification?

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Micromillimetres.

WE find in a recent number of the *Medical Record*, a letter from Col. J. G. Woodward, M. D., in which he gives the substance of his recent testimony in the Hayden case. This letter possesses more than a temporary interest, and we shall take the liberty of giving it to our readers in our next issue. In quoting from French and German writers, Dr. Woodward is frequently obliged to employ the term *micromillimetre.* Our readers will look in vain in most English and American works on the microscope for an explanation of this term, and it is not found in Webster's Dictionary.

It signifies the 1-1000th of a millimetre, and the unit and its name were, we believe, first suggested by Harting, many years ago. Harting also suggested the contraction mmm., or the Greek μ as the symbol for the micromillimetre, and the term and its symbol are frequently used by French and German microscopists.

About ten or fifteen years ago, however, the prefix *micro* came into general use in English in certain departments of physics, and here it had an entirely different signification, as it denoted the *one millionth* part of the unit. And about five years ago the British Association for the Advancement of Science adopted this signification which was embodied in the report of the Committee on the Selection and Nomenclature of Dynamical and Electrical Units. As this report, which includes the relations of weights and measures to all measurable quantities — mechanics, hydrostatics, strain, astronomy, sound, light, heat, electricity, magnetism, etc., has been adopted unanimously by the scientific men of Great Britain, and has also obtained very general acceptance amongst the physicists of this country, the prefix *micro* will undoubtedly be generally understood to mean a millionth part, just as the prefix *mega* means a million times. It will, therefore, be a very unfortunate thing if microscopists retain the word "micromillimetre" in the sense in which it was used by Harting. Such special use of the prefix *micro* will give rise to endless confusion and misunderstanding, and will tend to separate microscopists from the rest of the scientific world—a most unfortunate result. And in any case we cannot see the advantage which is claimed for such a term. Certainly the expression 2 micromillimetres is not more intelligible than .002 millimetres.

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Amateur's Hand-Book.

TO save disappointment, it may be well to notify our readers that the "Workshop Companion" contains *all* the matter that is found in the "Amateur's Hand-Book." Those, therefore, who buy the "Workshop Companion" do not need the "Hand-Book."

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Dr. Pelletan's Journal.

In a recent issue, we stated that Dr. Pelletan's Journal de *Micrographie* had suspended publication. We hasten to announce that we have just received two numbers of that journal filled with the usual collection of excellent matter. Dr. Pelletan, through his journal, has done good service to the cause of microscopy, and we trust that he will have abundant success with it.

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The American Society of Microscopists.

A FULL report of the proceedings of this society at its meeting at Buffalo, appears in this journal for October, November, and December, 1879. The President's address is given in full as well as several of the papers read at the meeting.

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Volume I. Out of Print.

WE regret to be obliged to announce that Volume One of the AMERICAN JOURNAL OF MICROSCOPY is out of print, and can no longer be furnished to clubs.

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Cleaning of Slides and Thin Covers.

There is, perhaps, nothing so tedious and disagreeable in microscopic manipulations, as the cleaning of slides and thin covers, whether they be new, or have been used before, and a short description of an easy method of overcoming the difficulty, I have no doubt, will be acceptable to every microscopist. When new, both slides and covers, are more or less greasy, from being handled by the workmen, grinding, cutting and packing them, and no amount of rubbing with alcohol will remove this thin film of oil. I, therefore, place the slides for a few hours in the following solution:

Bichromate of Potash, 2 oz.
Sulphuric Acid, 3 fl. oz.
Water, 25 fl. oz.

in such a manner that the brown liquid covers them completely; I then rinse them under the tap, and stand them on edge on several thicknesses of blotting paper. When dry, they are chemically clean, and require no further rubbing. Before mounting on them, the dust should be brushed off with a camels-hair brush.

With new covers, I proceed in the same manner, placing an ounce or so of them in a wide-mouthed vial, covering them with the cleaning solution, and shaking them up occasionally, so that the covers become separated from each other. After three or four hours, I pour off the acid solution, and wash the covers in the bottle with water, pouring it on and off, until the water remains colorless, after continued shaking of the bottle. When wanted for mounting, a cover can be taken out of the bottle with a pair of forceps, and wiped dry with a linen rag. Cleaning covers in this way, I not only get them thoroughly clean, but also break very few of even the thinnest.

When I desire to clean off specimens which have been mounted, either in balsam or in a watery medium, so as to save both the cover and the slide, I slightly warm the specimen over a spirit lamp, and push the cover with a pair of forceps into a vessel containing alcohol and hydrochloric acid in equal proportions. The slide, after having scraped off the balsam or cement with a knife, I drop into the bichromate of potash solution, in which they must remain several days, when they can be washed under the tap and dried on blotting paper like new ones.

The covers, also, are left a few days in the acid alcohol, and are then transferred to the bichromate of potash solution, and treated like new ones.

C. SEILER, M.D.

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Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Further of the Zeiss Objectives.

Ed. Am. Jour. Microscopy.—You very kindly published in the number for July, 1878, an account of a 1-8th oil immersion objective, which Carl Zeiss, of Jena, had then recently sent to me.

You will recollect that, although it had on its first reception, proved superior to any objective I had hitherto seen; yet, on being subjected to the most careful and rigid tests by many of the most eminent microscopists in the country, notably, Professors H. L. and J. E. Smith, it had been reported upon by them as not fully answering their expectations. On its return from its journeyings, the defect had become so evident, that I returned it to its maker for revision.

On inspection, it was discovered that a slight defect in the setting had permitted the introduction of a minute quantity of the immersion liquid; which had gradually spread over the front lens and thus gradually impaired the performance of the objective. As a matter of simple justice to Mr. Zeiss, I have thought it but right to beg of you to make this explanation.

Since then, I have received from the same skilful maker, three homogeneous immersion—as he now prefers to call them—objectives, a 1-8, 1-12, and 1-18. Of these, I will only say that the 1-8 fully justifies the statement I made with regard to the first one. The 1-12 is, I believe surpassed by no objective in this country, as Dr. Woodward says, that it is fully equal to the museum 1-12 of Zeiss, and the 1-18 is excelled, if at all, by the 1-12 alone.

L. M. WILLIS.

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

New York Microscopical Society.—The Regular Meeting was held January 2, 1880. President Hyatt in the chair. Fourteen members in attendance. There was present, as a visitor, Mr. S. H. Gage, of Cornell University, well known as an active worker, as well as by some of his writings. Among these, his "Laboratory Notes" and his articles on the "Ampulla of Vater, and the Pancreatic Ducts of the Domestic Cat," which were published in the *American Quarterly Journal of Microscopy*. He, after being introduced to the members, gave a short account of the work they are doing, by means of the microscope, at Cornell. He stated, that within the very brief time to which the student is limited to the one year, of which a very small proportion of his time can be devoted to these studies, that the most they can do in that way is to give the students the rudimentary principles in the use and handling of the microscope, and have them do some preparing and mounting of histological and other matter, simply to give a good foundation for their future guidance and practice. Mr. Hitchcock gave a short description of Prof. Rogers' micrometer ruling machine, which he had examined when at Waltham, recently. Exhibited by Mr. Hyatt: The palate or tongue of the common black marine snail; a pretty object, to which he called attention, showing that the *older* teeth on the one end or base of the tongue were wearing off, while new ones kept growing at the other end, and were very sharp. Mr. Hitchcock distributed to the members some sections of petioles of the *Nuphar advena* (yellow water lily), which had been cut and sent in by Dr. Newcomer, of Indianapolis, Ind. Mr. W. Wales exhibited one of Zentmayer's new Centennial Microscope Stands, with some recent improvements, which stand is so well known for its beauty and superiority that comment would be superfluous.

At the Annual Election, which took place on January 13, 1880, the following were elected as officers for the ensuing year: Romyn Hitchcock, President; John L. Wall, Vice President; W. H. Mead, Rec. Secretary; B. Braman, Cor. Secretary; W. C. Hubbard, Treasurer; F. M. Deems, Librarian and Curator; C. S. Shultz, James Warnock, David Benson, Auditors.

The Annual Meeting was held January 16, 1880. President Hyatt in the chair. The President made his annual report, stating, among other things, that the Society was in a prosperous condition. After leaving off some members who were dropped for arrearages, the Society now was made up of 32 active, 14 associate, and 3 honorary members, with a good prospect for more to be added very soon and from time to time. Mr. E. C. Bogert, of this city, was proposed as an active member. After considerable routine business had been transacted, the annual reports from the officers submitted, and amendments to Constitution, etc., had been passed, the meeting adjourned.

CHAS. H. SHULTZ, Rec. Secretary.

Microscopical Society of Liverpool.—The Eleventh Annual Meeting of this Society was held at the Royal Institution, on Friday evening, January 16, 1880. Rev. W. H. Dallinger, President, in the chair. The Honorary Secretary announced the valuable donation from Col. Woodward, U. S. Army, Washington, an honorary member of the Society, of a work entitled "Medical and Surgical History of the War of the Rebellion," illustrated throughout with enlarged photographs of microscopic objects. Rev. W. H. Dallinger and Mr. John Abraham were elected Vice-Presidents for the ensuing year. Mr Isaac C. Thompson was re-elected Honorary Secretary, and Mr. W. J. Baker, Honorary Treasurer. The following names were added to the committee in place of five who retired by rotation, viz.: Mr. G. F. Chantrell, Dr. Drysdale, Rev. W. Banister, Mr. T. C. Ryley, and Mr. F. T. Paul, F.R.C.S. Several new members were elected. The President elect, Dr. J. Sibley Hicks, delivered his inaugural address, choosing for his subject the "Embryology of the Lower Vertebrates," with special reference to the development of chick. He pointed out the striking similarity which exists in the early stages of development in all animals. After describing some of the most important features in the early stages of development in the chick up to a period when it could be prepared in its entirety, as a transparent object for microscopic examination, he proceeded to describe the evolution of the heart, comparing the various forms that organ assumed during its gradual development in the embryonic condition, to the adult heart of animals of a lower order, commencing with the dorsal vessel of the insect and gradually ascending to the incomplete four-chambered heart of the reptile. The address was illustrated by means of skilfully prepared diagrams. At its close, on the motion of Dr. Carter, a hearty vote of thanks was accorded to Dr. Hicks.

Microscopical Society of Camden, N. J.—The Annual Meeting was held January 8. President A. P. Brown, in the chair, and a large attendance of members.

The opening business being disposed of, the annual reports of the Secretary and Treasurer, Board of Managers, and Curator were read, giving in detail the various operations of the Society for the past year. The Secretary reports the receipts as $211.92; expenditures, $200.50; balance in hand, $11.24, with dues, fees, etc., accruing to $62.00. The membership of the Society is 35, with 9 additional members elected at this meeting.

The Managers reported two social receptions and one public exhibition as having been held, the latter a grand affair, in which most of the opticians of Philadelphia and the West Chester Microscopical Society took part. The society have attended as exhibitors three Microscopical Soirees, two of which were at the Philadelphia Academy of Science, and one at West Chester, Pa. Two scientific lectures, one by Rudolphus Bingham, and one by Prof. E. F. Moody, have so far been given this season, and a Telephone Concert by Heber Robinson, with exhibition of objects under gas microscope by Dr. Middleton and H. S. Fortiner, following.

The President read his annual address, in which he reviewed the rise and progress of the Society from its organization at the house of J. L. DeLaCour, Esq., in November, 1878, to the present time. Starting out with eighteen members, it to-night has a roll of 44, with a local habitation comfortable and commodious, and a name for energy and good works in the cause of science highly creditable for its age and members. The liberality of its members has furnished the room and contributed its handsome and valuable cabinets. Their taste has adorned the walls with works of art and the pictures of eminent scientists, while its financial affairs have been so admirably conducted as to establish it on a firm basis with no debts to annoy or embarass its future. The members, both active and contributing, are enthusiastic, and the progress made in the various departments of microscopy beyond most sanguine expectations; the co-operative principle was adopted in the beginning and has been recognized and maintained throughout, and to those principles it owes much of its substantial prosperity and present condition. The Society was not intended to be composed exclusively of experts; those, to be sure, are welcomed and desired, as the means by which a knowledge of nature and the lessons it teaches us may be more widely disseminated to our less informed associates, to encourage and instruct the tyro in science, and to render the ways of wisdom generally attractive and interesting to all so blessed by Providence with education to comprehend. Membership in this Society, therefore, does not imply a high degree of scientific attainment, any more than membership in the O. U. A. M. means that one is a practical mechanic. It has a higher significance; it does mean, however, that the persons so privileged are cultured, capable of, and as willing to impart their knowledge to others, as they are to receive instruction themselves from the investigation of natural objects which surround them, and the laws by which they exist; or that they are seekers after that fountain of knowledge which in the battle of life they have been deprived of, the waters of which tend only to refine and elevate.

Various recommendations were also contained in the address, looking to the future usefulness and prosperity of the Society, which will be discussed at the next regular meeting. The election resulted mainly in the re-election of the old officers, who are: President, Albert P. Brown, Ph. G.; Secretary, Joseph L. De La Cour; Treasurer, Louis T. Dercusse; Managers, C. H. Kain, H. S. Fortiner, Robt. Patterson; Curator, Prof. Edward F. Moody, Ph. D. Owing to the amount of business to be transacted the exhibition of objects was not as large as usual, the most noteworthy being a specimen of the larva of the carpet beetle (Anthrenus Lepidus) by the President, and specimens of a new find of diatom from Carson City, Nevada, by C. H. Kain, Esq. On January 22, Dr. Walter M. James, of Philadelphia, was to entertain the Society with an interesting lecture, "Dust," and illustrate the subject by a number of the finest microscopes.

EXCHANGES.

Nicely mounted slides, opaque, of the coal-tar products, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material; chemical name and formulæ attached; about a dozen varieties on hand. F. L. Bardeen, M. D., 30½ Meigs St., Rochester, N. Y.

Wanted, California or West Coast Algæ, for Atlantic or West Coast mounting. Rev. J. D. King, Edgartown, Mass.

Devonian, upper and lower silurian, carboniferous and cretaceous (Texas) fossils, given for others; lists exchanged; tertiary and cretaceous species especially desired. Also land and fresh-water shells, especially of the family *Unionidæ*, and minerals for fossils, other shells, or minerals. Berlin H. Wright, Penn Yan, N. Y. Reference, Ed. this journal.

Wanted, parts of brain or cord, man, supposed to be diseased; will give mounted slides of above, or choice of numerous histological preparations. Richard H. Lemmon, M. D., Castle Craig, Campbell Co., Virginia.

Slides mounted from injected sheep's kidney, human kidney with Bright's disease, rat's kidney, rat's liver and others, exchanged for any good and interesting slides. C. Blasdale, M. D., Jericho, Queens Co., New York.

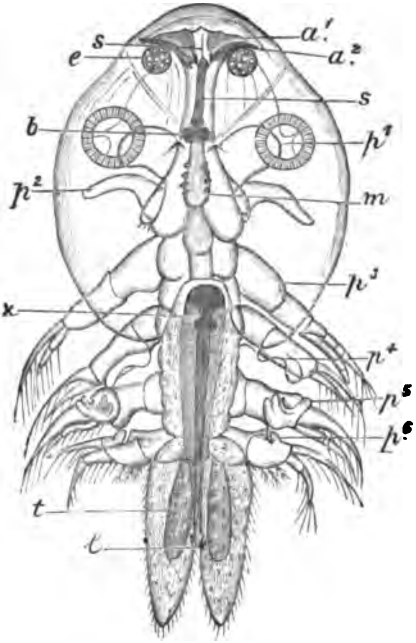

Fig. 1.

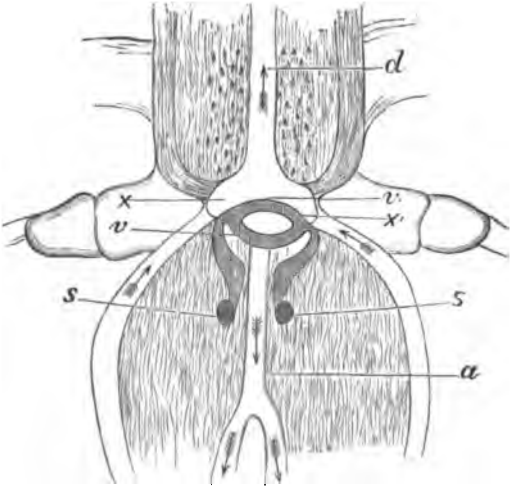

Fig. 5.

ARGULUS STIZOSTETHII, N. S.

THE AMERICAN
Journal of Microscopy,
AND
POPULAR SCIENCE.

VOL. V. NEW YORK, MARCH, 1880. No. 3.

Argulus Stizostethii, N. S.

BY PROF. D. S. KELLICOTT, BUFFALO, N. Y.

FISHERMEN accustomed to take the Blue Pike, *Stizostethium Salmoneum* Jor., from the Niagara River at Buffalo, have at different times told me, in answer to inquiries about "fish lice," that this fish, during midsummer, is always lousy. They account for it by saying, that when the water is warm it gets too lazy to take food, that it then gets poor, and through its inertness becomes infested with lice. After giving this fish especial attention for several months, I conclude that the fishermen are correct, so far as the habits of the pike are concerned, and it was not until August of the present year that I found the creature referred to by my friends. It proves to be an *Argulus*, and considering the number of fish of this species that I have examined expressly to discover external parasites, finding none until this time, I conclude that they are at least not common at other seasons. After comparing the parasite with such species as are known to me, with all species described in North America, and with such European forms as can be obtained, I conclude that it has not been described. I present in this paper an account of it by which it may be recognized in the future, adding more or less of the detailed results of my observations and study of the species. I have had a fairly good opportunity to study it, as I have had numerous living examples of both sexes; moreover, it is a transparent species of considerable size. I have been obliged to write without the privilege of the monographs of Leydig and Claus on the anatomy of these forms, save such general statements and conclusions as appear in our manuals and in the English microscopical journals. This is a disadvantage, the only compensation for which resides in the fact that my paper expresses the results of the independent observations of an observer without predilection.

The figures were engraved from drawings made under the camera lucida, and are mostly confined to illustrating parts of organization peculiar to the male. As the figures most commonly met with in our books are of the female, these may on that account, prove to be more useful to the readers of the journal.

The parasite occurs usually on the top of the head of the fish; when there are several, they are, as a rule, huddled together, often in heaps, so the knife may remove a number at once; it occurs also on the fins; none have been found in the mouth cavity. During August and the early part of September, I took a good many examples of the fish, scarcely one of which was without one or more of the parasites; some gave many, twenty were taken from one lean and tormented host. I have taken pains to examine other sorts of fishes taken along with these, but have not found the parasite on any other species. Still when put into my aquarium with a small specimen of *Lepidosteus osseus* and some minnows, they shortly locate on them, fastening, as before, to the head and fins of the gar-pike, but to any part of the minnows: these latter soon die, killed apparently by the *Argulus*. When they were first put into the trough, the small fish would pursue and catch them, but would eject them with a suddenness and a queer expression of frustration that was most amusing; in a few minutes *Argulus* could swim about unmolested by the minnows. The gar also expressed his dislike for the new comers by recoiling in evident fear from one seen approaching. The parasite seems to retain its hold without often moving, e.g., a large female fastened to the end of the long nose of a gar, where it clung for several days despite the vigorous efforts of the fish to dislodge it. I have examples of another species in my aquarium, which have now remained attached to the same spot of their host for two weeks. I find that as the water of the river gets colder, late in September and along into October, the pikes are in better condition—not so many "razor backs"—and fewer are infested. The fishermen assure me that after "frosts" these fish get fat, and then no lice are found on them.

The aversion, or dread, fishes exhibit for these parasites, the fact that the lean examples of the blue pike are the ones principally troubled, and that the minnows supposed to have been killed by them, had their scales removed from places where the parasite had been attached, with the denuded surface in some instances congested, may point to the conclusion by Leydig, viz: that the proboscis, or spicula, is a poison organ. (Siebold's Com. Anat., 329, note).

It seems quite appropriate that the species, if unnamed, should bear that of the fish from which it has been so plentifully taken, even if it should prove to occur on other hosts of different genera; therefore, I propose to call it ARGULUS STIZOSTETHII.

Size. Length of adult, male, .33 to .38 of an inch; length of abdomen .12 of an inch (average); length of female, .45 to .55 of an inch; length of abdomen, .17 of an inch, (average). Individuals are often taken which show well the characteristics of their sex that are not above one half the size of the adult.

Color. The males and immature females, are nearly colorless, with special organs brown; the mature females have the carapace, legs and abdomen pale pea-green, the upper side of the thorax rendered quite dark by many oblong spots in the integument; these appear as the eggs begin to mature in the ovaries. There is a light line along the dorsum; under side of thorax rendered white by mass of ripening eggs.

The carapace is broadly ovate, deeply cordate, somewhat more rounded in the males. In the females it barely covers the third pair of natatores, in the male the second pair only.

The abdomen is about one third the entire length, divided almost half its entire length; the lobes narrow, subacute in the male, apex slightly more rounded in the female, and the lobes relatively broader. At the bifurcation on the upper surface, stand two prolonged tubercules whose rounded terminations bear five hairs each; these bodies set backwards and outwards, (Fig. 1, l.) The surfaces of the abdomen, the under surfaces of the legs, and especially the borders of the shield, are beset with pointed, short teeth.

Antennæ. First pair two (or four) jointed, the basal piece seen from below triangular, chitinous, with a strong hook on the inner posterior angle; second joint chitinous, ending in a long slender hook turned downwards; on the basal part are two hooks; a little beyond the middle of this uncinate part, articulated to its upper surface, is an auxiliary two-jointed part, (third and fourth antennal joints) the first part of which is cylindrical, slightly curved, reaching to the end of the terminal hook of previous joint. It bears a short segment which terminates with six setæ; there is a robust seta at the articulations of these pieces. The second antennæ are four-jointed, the basal joint is thick, with hook at base, the second joins it in a knee-like joint at right angles, the last three pieces successively diminish in size and length with setæ at the articulations.

Limbs. The first pair end in the usual form of cupping disc; the second are five-jointed, the last terminating with two hooks; the basal joint has a thick cushion covered with setaceous teeth. There are three stout brown teeth on its posterior margin; the four pairs of swimming legs, or natatores are also of the usual form; the first, second and third are each three-jointed; the fourth, two; each terminates with fingers, or pinnulæ; of these feathered oars the upper ones consist each of one piece, the lower one of the first pair is three-jointed, the two end ones are short, cylindrical, without plumes, the final one bears three pointed pieces which seem to act as pincers; the lower finger of second pair is undivided; those of the last two pairs are two-jointed, the articulation being near the middle. *There are no recurved pinnulæ on any of the natatores.* In the male, the outer divisions of the third and fourth, and the middle one of the second pairs of natatores, carry distinctive sexual appendages. I describe them as follows: That of the fourth pair (Fig. 2) consists first of a robust brown body, (h) arising from the front margin at outer angle; it turns downwards and obliquely forwards; it is almost opposed by a second similar, but colorless organ, (g), arising from the same margin; there is a third piece, a chitinous tooth (n) springing from lower border, pointing towards the first men-

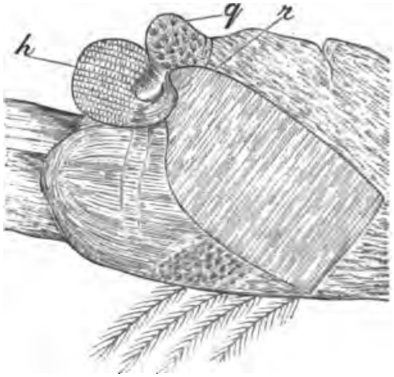

Fig. 2.

tioned organ; this organ (h) has its surface covered by scale like elevations. The third pair have special parts on both the inferior and superior surfaces. In the median line on the sternal face of the segment bearing this pair, is a chitinous ridge which sends lateral branches to the limbs; on the basal joint this ridge is prolonged into a blunt tooth which is met by a similar one on the succeeding segment; these seem to prevent the limb from being bent downwards at this articulation. The whole upper surface of the last segment is occupied by a complicated set of organs (Fig. 3); on the anterior border are, three fleshy protuberences directed obliquely outwards (e); at the base of the first of these, is a pointed brown piece; just back of it another similar part (h); in front of this, and back of the first and second protuberences is a deep cavity (p), which may be traced beneath h; posteriorly to p, stand two clavate bodies (b, b); foreshortened in the figure as they stand vertically, they arise from a common base and can be approached like the blades of pliers. They are apparently clasping organs; the surface is similar to that of h, Fig. 2. Back of these is a blunt fleshy piece directed back (a), at its base there is another turned front (g). The surface of the organs represented at a, e, g, and the general surface of the segment are clothed with short stiff hairs. The organ of the second pair occupies the lower surface of the middle segment; it projects back beyond its posterior margin; it is a fleshy body, its surface clothed with setaceous teeth, it can be, at least, nearly closed hand-like by the approach of its extremities, (Fig. 4.) On the basal part of the last pair, are heel-like organs, larger in the female than in the male. Whatever office besides they may perform, they are used by the female to place her eggs in order, when they are left to the warmth of rocks and water for incubation. The pointed "narrow laminæ" at the base of these organs in female of other species, are wanting in this. There is a capitate papilla situated in the median line at the termination of the thorax of the male.

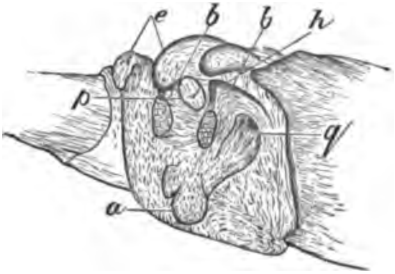

Fig. 3.

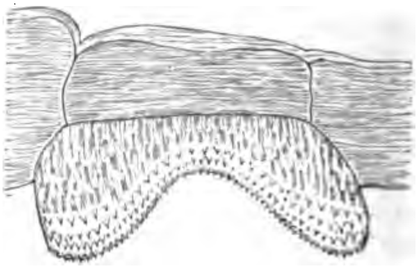

Fig. 4.

In the basal part of each abdominal lobe is a well marked brown sexual body (Fig. 1, t.) In the female they are small egg-shaped vesicles (spermathecæ). In the male, they are long cylindrical sacs, (testes), pointed at their upper extremity, rendered conspicuous to the eye by brown spots in the tissues of the sac. Under a considerable magnifying power they appear striated in the direction of their length. In the back of the male, in the notch of the carapex, is another distinct brown ovoid organ, (seminal vesicle); there are tubes (ductus deferens) of same color extending from its anterior extremity to vesicles (accessory glands ?) of irregular form situated in the last thoracic segment near the insertion of the last natatores, concealed by the muscles moving these limbs; the abdominal sacs communicate with the same; this dorsal body and its lateral prolongations often exhibit peristaltic movements (Fig. 1, x.) The three organs last mentioned, after the death of the Argulus, often change their color to light purple. These bodies are easily removed by the dissecting needle. When thus removed and crushed under the cover glass, there exude a fine granular matter and hosts of spermatozoa. These latter are enormously long rods, or threads. I can make out no distinctive characters, except that one end is possibly coarser than the other. Those from the sacs and dorsal body of the male are in some examples, as a rule, coiled into rings, .0008 of an inch in diameter. In a few instances I have seen the coils—from the dorsal vesicle—in motion, slowly uncoiling and again coiling, or the coil turning about. When the fluid dries on the slide, the coils appear invariably to un wind. Those from the spermathecæ of female I have always found unrolled.

The spherical ova are placed in irregular patches of single layers, glued to supports by a frothy cement. They are at first white, changing to yellow, in from two to six days. They measure .016 of an inch in diameter. They hatch after sixty-eight days incubation

With regard to the union of the sexes, I have to say that the statements of authors to be found in our manuals and Zoölogical dictionaries, have been in great part verified, still, I can not in the least redüce the hiatus as to the real office of the several complex auxiliary organs of the male natatores. I have at different times seen the spermatic filaments entangled among the bristles and parts of these organs. While the male remains fastened to the carapace of the female with his sucking feet, he continues at intervals to bring into contact these organs. Copulation is accomplished by passing the third and fourth natatores beneath the base of the abdomen.

In regard to the circulation, I can verify what may be found stated by various observers, at least, that pertaining to the streams to eyes, antennæ, limbs and carapace, but I find less definite observations relating to that part that may be called truly vesicular. I have indicated in Fig. 5, the organs which appear to me to control said circulation. In the figure, d, is the dorsal vessel, a tube of uniform diameter until it reaches a point a short distance back of the brain where it is constricted to one-half or one-third its general size; v and v^1 represent two positions of a thick membrane which moves with every pulse from position v to v^1, and return; x and x^1 are valves, they seem to me to be mere pouches, but I am undecided as to their true nature; the arrows indicate the direction of the blood currents. These are as follows: When the pulsating membrane is at v, currents pass into the space in front of it, from the lateral or border currents of the abdomen, through the valves x and x^1; as the membrane moves to v^1 these close and the blood is forced along the dorsal tube; there is, also, an isochronal dilation posterior to v of a vessel that is deeper in the tissues, and receives the blood coming from the body; this abdominal vessel (a) divides at the division of the abdomen, it also sends lateral divisions across the under surface of the lobes to the marginal streams. The presence and action of the valves at x and x^1, may be seen to the best advantage when the Argulus is under sufficient pressure to just prevent the heart from driving the blood forward; it then moves back and forth through the apertures exhibiting the valvular membranes.

I am aware that "Leydig denies that these lamellæ, [abdominal lobes,] thus composed, [1st, of simple glands; 2nd, of rich muscular net work; 3d, of a lacunal net work;] have peculiarly a gill function," still, on general grounds, I am led to think that they have this function to a higher degree than any other part. As I trace the circulation, all of it concentrates from the body into this organ, where it spreads out over the surface with the thinnest of membranes separating it from water currents; from thence it is received by the heart, and distributed to the whole organism. The corpuscles are pyriform; when seen by high powers, they exhibit an appearance similar to that of the white corpuscles of higher forms.

The alimentary canal I make out as follows: first, a short œsophagus; it is concealed for the most part by the bulb; it expands into a broad flask-shaped stomach, which exhibits at its upper part—beneath the upper pair of sternal hooks—a transversely corrugated band; over its general surface there are colorless glands; the muscular walls are firm, and the organ often displays vigorous peristaltic motion; the intestine opens into the stomach on its upper surface a short distance above its posterior extremity; this point is betweeen the first natatores. The entrance to intestine seems to be guarded by longitudinal folds; this intestinal tube gradually expands, attaining its extreme diameter just above the insertion of the third swimming feet; from this it contracts to the uniform tube, which begins with the abdomen and ends at the division of the same. In the part from the stomach to the rectum there is a lining layer of granular or glandular brownish matter; when too great pressure is put upon an individual, the part which I call the rectum, sometimes snaps at its upper end, then protruding from the anus between the lobes.

I have omitted many particulars of structure and habits, which I have hit upon during my acquaintance with this species, keeping to such as I have thought would be most useful to the readers of this journal.

The Microscope and Its Parts.*

BY ED. BAUSCH.

IN a society like this, where there are different stages of advancement in the knowledge of microscopy, it is a difficult task to speak intelligibly on a subject and at the same time make it interesting to all. In the topic I have chosen I will offer facts which I hope will prove useful to the majority, and which may reveal new phases to those more conversant with the principles of optics. I will omit, as much as possible, points that may be gleaned from books, and will confine myself in a concise form to those which experience teaches me are of the greatest importance. I hope that, if in the course of my remarks, I should not be sufficiently explicit, the members will not refrain from asking for an explanation.

We all know the derivation of the word microscope, but few of us perhaps have dwelt long upon the thought of what it actually is. From our first acquaintance with the compound microscope, we have the impression that it is composed of several mechanical and optical parts, the latter of which give us highly magnified images, and we sometimes forget that it is the latter only which really form the microscope. In its modern construction it is composed of an eye-piece and objective, having correlative distance and combined by a tube, while the stand or mechanical appliances are merely accessories for the easier attainment of the work.

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* A paper read before the Rochester Microscopical Society, Thursday Feb. 9th, 1880.

I see no reason why we should not, in ordinary parlance, call the entire instrument a microscope; but take from it its optical parts, we have then simply a sample of good or bad mechanical ingenuity and workmanship, as the case may be.

I will devote my first attention to the stand.

The first requisites in it are stability and entire freedom from liability to vibration. The proportions and weights of its parts should be such as to bring the centre of gravity as near as possible to the base, so that, with or without inclination of the body it will remain steady. The bottom of the base or foot should not present an unbroken surface, as with this it is evident that when it comes in contact with an uneven surface it becomes unsteady. The modern and certainly only true form is to have three projections, which present the only points of contact. I would advise those having an instrument with a flat base to cement to it at proper distances three rubber pads. I prefer rubber as in case of a slight tremor the vibratory motion is transmitted to it, while the stand remains steady.

Whatever is the form or construction of the stage, it should be able to bear the slight pressure used during manipulation. No stage has yet been made which, under sufficiently high magnifying power, can not be shown to give way under a strong pressure. In many stands this quality serves the purpose of a fine adjustment.

The coarse adjustment or quick motion is gained by a sliding tube, a screw arrangement or a rack and pinion, the latter of which is the favorite form in this country.

The fine adjustment or slow motion is constructed in various ways, but no matter how, it should be faultless in its work. Nothing exasperates more and proves a greater hindrance to good work than a poorly made fine adjustment. The form which varies the distance between the eye-piece and the objective, will, I think, become obsolete, as it should. We all know that any change in the length of the tube causes a difference in the magnifying power, and it is evident that when this principle is involved in the fine adjustment, it makes it unreliable for accurate measurements.

In the first construction of the microscope, the eye-piece and objective consisted each of a single lens. As it gradually developed, the Huyghenian eye-piece, which had previously only been used with the telescope, was successfully applied to it, and the application of achromatism to the objective finally gave it the construction which, with modifications, characterises it to-day.

It is an error to suppose that the rating of objectives has any connection with working distance, angular aperture, or diameter of front lens. It merely indicates the equivalent of a single lens having the same magnifying power. For instance, an objective marked one half inch, magnifies or should magnify the same as would a single lens having this focus; but it is one of the "tricks of the trade" not always to hold to this rule. Some opticians have a habit of marking objectives less than their actual value, such as marking an objective one-quarter which really has the power of a one-fifth or perhaps a one-sixth. Other conditions being the same, it is evident that these objectives will have the advantage in comparison with one which is correctly marked. In the comparison of objectives, it should therefore be one of the first considerations to determine by measurement the actual magnifying power of each.

There is a difference of opinion on the meaning of working distance. By many, it is defined as the distance between the object and the front of the objective when the former is in focus; by others, as the space between the cover, where this is used, and the metal projecting over the front lens. By the former party it is held as being a quality of the objective which is not dependent upon the cover, while the other claims that it is, and that in practical microscopy only that space can be called working distance, which allows the objective to be worked without detriment to it or the object. If the first party be right, then we should have a positive term, to express the second definition, for it is evident that if a high power objective has considerable such working distance on an uncovered object, and by the interposition of a cover this is lost, or we can not get the object in focus, then this claim for it is of little practical value. In objectives having a long range of adjustment, both definitions become practically the same, as the difference between an uncovered object and one with cover, and a dissimilarity in the thickness of the latter, is partly compensated in the adjustment. In the low powers working distance is of minor importance; in the higher ones, however, it is an important factor in making a successful objective. Many objectives, especially those of Continental make, have a super-abundance of protective metal, and are thereby robbed of a quantity of working distance—a most serious fault.

We all know what a diversity of opinion exists on the question of angular aperture, and even on the actual meaning of the word. The old definition represents it as the angle formed by the extreme rays that pass through the objective. The newer and, I think, correct one is to take the angle formed by the rays that give a distinct image. There is quite a difference between these two definitions. For instance, suppose that the front system in an objective has a larger diameter than the formula calls for. A larger number of rays will enter it than the posterior systems can transmit to the eye-piece. These extra rays give what is called diffused light, and as they do not assist in forming an image, they are practically worthless, if not actually injurious. If we use a certain eye-piece, constructed for this purpose, we will get a small, sharp picture, and by revolving the mirror obliquely until it (the picture) disappears, we get the impression that this is the aperture, whereas, by using a Huyghenian eye-piece, we find that we will have to turn back the mirror in order to get a distinct image. The greatest degree of obliquity of the mirror which gives the image well defined and not blurred, is evidently the angle which transmits the useful rays.

There is an idea prevalent among many microscopists that the angular aperture of an objective has an influence on the size of the field—that is, the larger the angular aperture, the larger will be the field. Now, this is not the case. The diameter of the field is limited entirely by the eye-piece, or rather by the diaphragm in it, and has no connection with the aperture of the objective. Neither is it, as is often supposed, in an inverse ratio to working distance. You can construct a one inch objective of thirty degrees angular aperture, which has three-fourth inch working distance, and another of the same aperture with only one-eighth inch working distance. With higher powers this holds better, but does not become a rule.

For many years there has been and will be for a long time to come, a conflict between the adherents of large and small angle objectives. In my opinion both parties are too absolute, and lose sight of the fact that each kind has its advantages. I will state here in parenthesis that when I say small angle, I do not mean the imperfectly constructed objectives that rely upon the small diaphragm behind the systems for an approximately good result. I do not think that the partisans of large angles can righteously condemn the others when they consider that they owe a large part of their interest in and knowledge of microscopy to the latter. They forget the fact that these objectives are to-day disseminating a knowledge among students, including the large class of amateurs, which cannot be disdained. On the other hand the other party does not acknowledge that large angles are absolutely necessary for certain classes of work.

I will mention a few optical facts which may help to give a better understanding of the subject and show the difference between the two.

It is generally accepted that a small angle objective has penetration, that is the faculty of looking into an object, while the large angle has resolving power, that is showing with extreme distinctness the particles that are in focus. In practice, however, this is not always the case. For although an objective may have a large angle, it may be and often is so imperfectly constructed that the other may excel it in every quality. On the other hand, besides the faults that the other may have, a small angle objective may be made by decreasing by diaphragm that of a large one and still not acquire penetration, for it is apparent that the course of the rays will be the same whether the diaphragm is there or not. However, in well constructed objectives this is the rule, and to make it understood we will take two objectives of the same power and best possible construction, for instance one of 50 degrees, another of 150 degrees. We will suppose that the front surfaces of these objectives are covered by opaque plates, each of which has but one small opening. As we have pre supposed the apertures, it is evident that the angles formed by the extreme rays of the cones that enter at these points, will respectively be the same as those mentioned. Rays beyond these angles will also strike the surface at these points, but as they will not be transmitted to the posterior systems, we need not consider them. From these two points draw segments of circles having for radii the distances to different points of the object, from which rays emanate. It is noticeable that the zones of the small angle objective are close together, and therefore take in almost every part of the object, whereas in the other this is not the case. By moving the incident points to different parts of the surface the same formation of rays will take place, and if the opaque plate be removed they will enter the entire surface under the same circumstances.

This is not a mathematical solution of the question, but will serve to show why a small angle objective will show, at the same time, parts of an object which lie at different depths—or has penetration.

We all know that after we have viewed a transparent object with central or axial light, and then use oblique light, that we can see its parts with greater distinctness, or if we are not able to judge the structure of an object with central light, oblique light will often enable us to do so. This principle is involved in objectives having large angular apertures, or so called resolving power. In these objectives rays will enter at a greater obliquity than is the case in one of small angle. Take for illustration an object having semicircular projections. The rays from the portions lying nearer the bases will give a sort of side view of these parts, which in conjunction with the front view will naturally give a more distinct image than can those giving a front view only. They will therefore show with central light what a small angle can only do with oblique light, and using the latter, the result is far superior to what the other can give under any circumstances. Besides this, they have the advantage that the light can be thrown to a comparatively greater obliquity, and as every additional degree assists in giving greater resolution—pre-supposing that the corrections keep step—to the same extent will the greater obliquity show the increased contrast between light and shade.

This property in large angle objectives will also serve to explain why they will bear more amplification. A number of rays are lost by refraction and absorption as they pass through the eye-piece, and this loss increases with the power of the latter. As there are a large number of rays transmitted from the same point in a large angle, a loss of some of them in a strong eye-piece will not seriously impair a sharp image, while on the other hand, in the other objectives, a loss of the same number will be proportionately much larger, and leaving but a remnant to form an image, this will be indistinct, or as it is termed, the objective will "break down."

There are many to day who ridicule the idea of using a large angle objective on anything except Diatoms. There is no question about the fact that if an objective will show well the markings on a Diatom, it will do the same on any other object. It simply remains to be shown which is best adapted for a certain purpose, and in this every microscopist must depend upon his own judgment to a certain extent, and to do so he must understand the principles involved.

The entire controversy can be presented in a few words. A small angle objective gives large working distance and penetration; one with large angle has shorter working distance and resolution. (I am still assuming the best possible construction in each.) The first allows the examination of an object with little or no adjustment; the second shows the same with greater distinctness, but requires to be adjusted to the different layers of the object.

The former, with the same power, has greater working distance, and in higher powers is more easily manipulated.

As to the matter of expense, the small angle does not require the same amount of work in its construction that a larger angle does, and therefore costs less, but in order to get a variety of powers a number of them are required, whereas approximately the same result is gained by a smaller number of large angled objectives and a variety of eye-pieces.

It is a pity that the Royal Microscopical Society of London did not make a larger standard when they adopted the "Society screw." At present, it is the impassible obstacle to opticians, but will have to break down before the advancement which is daily made in the construction of objectives, and in time we shall have a standard of larger size.

Among the many different forms of eye-pieces used in the microscope, the Huyghenian is by far the most common. It is composed of two convex lenses, the distance between them being equal to half the sum of their foci. A diaphragm with an opening of proper size is placed between them, to intercept all rays not required in the formation of an image. The one nearest the eye and smallest is the eye-lens, while the other is the field lens or collective.

As I have before stated the size of the field is entirely dependent upon the opening in the diaphragm. If we place an arrow under the microscope, its magnified image will form at the diaphragm. If the size of the opening will enable us to view the whole of it, and we replace the opening by a smaller one, we will see but part of it.

Complaints are often heard that the edge of the diaphragm is not distinct. As it lies in the visual focus of the eye-lens—and eyes are very unlike—it is natural that all should not see it with equal distinctness. It is placed in the focus of the normal eye, and if it is found that the edge is not sharply defined, it can be adjusted to individual requirements.

If the field should appear dusty, look for the cause of it on the field lens, which can always be unscrewed. Unless the objective has extremely short working distance, any dust or impurity upon it will cause a general indistinctness.

Many faults which are attributed to the objective, especially want of flatness of field, are very often owing to the eye-piece. When an objective is tested it should, therefore, be examined with several eye-pieces before judgment is given on its merits.

Every owner of a microscope has unundoubtedly had the question put to him, "How much will it magnify?" One gentleman, otherwise intelligent, not satisfied with the beauties I had shown him, even wanted me to show him some stars with it. The question should not be, how much will it magnify, but "what will it show with a certain amplification?" As I have shown there is a limit to the increase of power with the eye-piece, and in poorly constructed objectives, or those which have small angles, this limit is quite abrupt. If a certain eye-piece reveals nicely what we are looking for, there is no need of applying a higher one, for it will not show one whit more, except, perhaps, the faults that the objective may have. On the other hand, if, with a medium power eye-piece, we know that an objective will do certain work, say a fourth objective will show lines on P. angulatum, the same with a low power will utterly fail to show them, because they are so fine and close together that the eye is not able to distinguish them.

It is a matter of regret that when

the Royal Microscopical Society adopted the "Society Law," they did not make one for rating eye-pieces. Every maker calls them after his own fashion, and gives them any power. There is no doubt that it would simplify matters considerably, if the same rule that is now applied to objectives were applied to eye-pieces.

In general I do not advise the use of the draw-tube to gain amplification. Except in an objective with a long range of adjustment for cover, the gain of power is accompanied by an equivalent loss of definition The standard length between the eye-piece and the objective is ten inches, and as all objectives are corrected for this distance they should not be used with any other.

Medium and high power objectives without cover adjustment are corrected for a medium thickness of cover .15 mm. or .006 to .007 in. Where the covers differ materially from this thickness, the draw-tube can be made to serve the purpose of cover adjustment.

A few words on that useful little accessory, the camera lucida.

My attention was especially drawn to it a short time ago by a member of the society, who thought that one he had did not give satisfactory results. He complained principally about not being able see the pencil point. I could not explain the matter, but finally asked him if he required glasses for reading. Answering that he did, I saw the trouble. When using the camera lucida the distance between it and the table is ten inches. The reading distance for the normal eye is the same, and it is evident that if glasses are necessary to see distinctly while reading, they will also be required to see a pencil point. Therefore any one using glasses to aid the sight, should do so with the camera lucida.

It will also be found beneficial to darken the part of the table upon which the drawing is made. This can be done by interposing a paste-board between this place and the source of light. Through the camera lucida the image will appear much brighter and more distinct than would otherwise be the case.

Chase's Mounting Forceps.

HAVING experienced the annoyance and inconvenience attendant upon the use of the ordinary methods of placing glass covers upon objects for permanent mountings, I have devised for the purpose, the little instrument described below, which, in my hands has proved a success, and I hope may be found satisfactory to others who may try it.

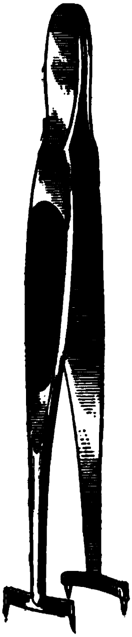
The forceps, as may be seen from the subjoined engraving, consists of an ordinary pair of surgeon's spring forceps, either straight or curved, having attached to each blade a circular strip of metal which carries a short pin-shaped foot. The feet being attached to the outer sides of the circular cross pieces, leave a ledge upon which the glass cover rests, when placed in the forceps to be used.

My method of mounting with the forceps is as follows:

Having placed the slide upon a self-centering turn-table, and the object carefully arranged upon it in the balsam, place with a clean pair of forceps the thin glass cover (which has previously been cleansed and set aside for use). in the jaws of the mounting forceps. Put a drop of balsam upon the side of the cover that is to come in contact with the object, and invert it over the object on the slide. Allow the feet of the forceps to rest upon the slide, and adjust them by the rings upon the turn-table, that are seen through the glass.

When the cover is thus carefully centered over the object, relax the grasp of the fingers upon the forceps, and the cover falls in place, causing a wave of balsam to radiate from the centre in every direction. The result is, that the cover is accurately centered, and the object peers up at you (gratifying sight) from the centre of the cover.

The slide may now be placed aside where it will be free from dust, and the few air-bubbles under the glass, if there be any imprisoned, will in the course of a few hours come to the edge, and then can be easily dispersed.



CHASE'S MOUNTING FORCEPS.

I have been able to mount in this manner delicate tissues, that would have been inevitably washed to the edge of the cover by the old method; and which were too delicate to have been moved back in safety to their proper positions.

Those who have occasion to mount groups of two or more objects under one cover, will find this method of great advantage, as the objects retain their relative positions as arranged upon the slide

It is a wise precaution while mounting, I think, to cover the object temporarily, when placed upon the slide, with a bell-glass, while preparing the glass cover as described above. I have found it convenient in centering the covers, to have a piece of white paper pasted upon the brass plate of the turn-table, with black circles traced upon it of the exact diameters of the various sizes of glass covers used. The circles upon the brass plate are generally so numerous as to be confusing; one seldom uses more than three or four sizes of covers.

R. H. Chase, M.D.

Washington, D. C.

The Size of the Blood-Corpuscle.

COLONEL WOODWARD, of the Army Medical Museum, having been a witness in the famous Hayden Case, his testimony was pretty fully reported by the daily papers, and upon some of these reports, medical and other journals based a criticism of Dr. Woodward's testimony which was not always justified by the actual statements made by the witness. In reply to certain comments which had previously appeared in that journal, Col. Woodward addresses the following letter to the editor of the *Medical Record:*

I cannot for a moment believe that it was your intention to misrepresent me in the editorial of January 10th, entitled "Further Expert Testimony at the Hayden Trial;" and yet you have actually done so by making use of the newspaper reports of my testimony in that case, in which, as is usual with newspaper reports of scientific testimony, there are a number of inaccuracies, and erroneous impressions are made as to several matters by the presentation of single sentences without the context. Will you not, therefore, as a matter of justice, give equal publicity to the following brief corrections and a few words of explanation?

You write: "Dr Woodward testified that the size of human blood-corpuscles in different persons was as variable as that of the individual; and the size also varied greatly even in the same animal." What I actually testified as to these points were substantially as follows: That the largest human corpuscle I had ever measured in any individual, including all ages, was 400 millionths (1-2500) of an inch in diameter, the smallest 222 millionths (1-4500). I said that I did not, however, for a moment believe that these dimensions represented the extreme limits, for G. Hayem (Rech. sur l'anat. normale et path. du sang, Paris, 1878, p. 44) has recently affirmed that in chronic anæmic conditions he has measured them as large as 12 or even 14 micromillimetres (the latter = 551 millionths of an inch), and as small as 2·5 or even 2·2 micromillimetres (the latter = 86 millionths of an inch). But even taking the limits I had myself measured as the extremes for healthy individuals, the difference in size between the largest and the smallest human blood-corpuscles was about as great relatively as the difference between the shortest and the tallest adult man; and as in both cases all possible intermediate sizes occur, I held that we are no more likely, by measuring ten, or fifty, or a hundred, or even a much larger number of corpuscles, to obtain an average size that will agree with the next set of similar measurements, than we are, by measuring the height of as many men, likely to obtain an average which will agree with the average height of as many more individuals measured elsewhere.

It was to this cause chiefly that I attributed the considerable differences between the statements as to the average size of the human red corpuscles published by the highest microscopical authorities during the last few years. You make me say: "The most recent authoritative measurements made the average diameter 1-3620 of an inch." What I really said was, that while many English and American microscopists continued to assume the infallibility of the alleged average size of 312 millionths (1-3200) of an inch, propounded by Gulliver in 1848, such able French microscopists as Cornil and Ranvier (Manual d'histologie pathologique, Part II., Paris, 1873, p. 498) placed it as low as 7 micromillimetres (*i.e.*, 275 millionths, or 1-3636 of an inch). The commission of the French Société de Médecine Légale (Annales d'hygiène publique, T. 40, 1873, p. 194), composed of Messrs Mialhe, Mayet, Lefort, and Cornil, which reported, June 9, 1873, placed it at 7·5 micromillimetres (*i.e.*, 295 millionths, or 1-3389 of an inch), with which Hayem (p. 43, op. cit. *supra*) and other recent French authorities agree. On the other hand, J. Pelouze and E. Frémy (Traité de chimie, etc., me éd. entièrement refondu, T. VI., Paris, 1865, p. 492) place the average as high as 1-120 of a millimetre (*i.e.*, 328 millionths, or 1·3048 of an inch), while the average usually accepted in Germany, that of Welcker (Zeitschr. für rat. Med., Bd. xx., 1863, S. 257), is intermediate between the foregoing, viz., 7·74 micromillimetres (*i.e.*, 304 millionths, or 1-3289 of an inch).

As for myself I did not pretend to make any general statement as to the true average size of the human red corpuscles, my experience being that the averages obtained by the most careful measurements of any moderate number of corpuscles differ considerably. As to this, I cited the figures I have published (Amer. Jour. of Med. Sci., January, 1875, p. 151, and Trans. of the Amer. Ass'n, vol. xxvii., 1876, p. 303), and added that several other average measurements of human blood recently made by me with every possible precaution also differed from each other considerably (as will be seen below).

As to the red blood-corpuscles of the dog, I testified that I had measured in this animal single corpuscles as large as the largest I have ever myself measured in human blood, others as small as the smallest in human blood, and every possible intermediate size. Here, too, on taking averages, I had arrived at variable results, as Gulliver himself did long ago. I explicitly stated that the general average of all the measurements I had ever recorded for the dog was somewhat smaller than the average of all I had recorded for man. Yet some of the averages I had found for fifty or a hundred or even more, canine corpuscles were larger than the smaller averages obtained for human blood; indeed, occasionally rivalled the larger. I mentioned further that I agreed with the view of L. Périer (Bull. des travaux de la Soc. de Pharm. de Bordeaux, 1877, p. 282 et seq.) that the blood of quite young dogs (up to a month or two old) more frequently contained very large corpuscles, and gave averages equal to those obtained from human blood, than was the case with older animals. I had, since the trial commenced, mounted several slides of the blood of a pup three weeks old, in which corpuscles measuring 400 millionths (1-2500) of an inch in diameter were by no means rare. (I may add that I have these slides, and will take pleasure in showing such corpuscles to any competent microscopist.) Fifty corpuscles on one of these slides gave an average of 326 millionths of an inch; forty corpuscles on a slide from another pup of the same age gave an average of 320 millionths of an inch; while twenty corpuscles from the blood of a full-grown dog gave an average of but 300 millionths of an inch. Measured with the same instruments, fifty corpuscles of my own blood gave an average of 324 millionths; forty, from another individual, gave an average of 327 millionths; twenty, from another, gave an average of 316 millionths. I added, that all these measurements were made with a new Zeiss homogeneous immersion 1-18 and a cobweb micrometer, the power being such that each division of the micrometer-wheel equalled 1-750000 of an inch. Every corpuscle in the group selected was measured, each being first brought to the centre of the field for the purpose, and those corpuscles which appeared to be other than perfectly spherical were measured in the long and short diameters, and the mean taken. In short, every known precaution was employed to secure accuracy.

In view of all the foregoing considerations, I did not think the microscopist is warranted in attempting to distinguish on oath between human and canine blood, even on preparations carefully made from fresh blood. If he makes a *guess* based on the average size of fifty or a hundred corpuscles, he will, no doubt, often come out right; but he will also occasionally come out entirely wrong, and the difficulties in the case of corpuscles soaked out from dried stains are of course still greater.

You remark: "Dr. Woodward took in general a very pessimistic view of micrometry;" and again: "The impression given by Dr. Woodward as to the exceeding vagueness and inaccuracy of microscopic measurements was unjustifiably strong." I do not think, Mr. Editor, you would have made either remark had you heard what I actually said. I pointed out, it is true, several important sources of error that would lead to very mistaken results, if neglected, besides the differences between micrometers, on which you very properly insist; but I also expressed the opinion that if every precaution *was* taken, the size of each individual corpuscle measured could be obtained with our best modern resources to within two or three millionths of an inch, which, I may note here, is about as close as Professors E. W. Morley and W. A. Rogers (Proceedings of the American Academy of Arts and Sciences, 1878, p. 164 et seq.) found it possible to measure the distances between sharply-defined ruled lines on glass. What I did express doubts about was the significance of averages taken from the measurements of comparatively small numbers of bodies so variable in size as blood-corpuscles are. And, indeed, I may say here that I am glad to admit, nay, I go further, I insist, that micrometry has considerably advanced since the days when Gulliver fixed the 1-3200 of an inch as the average size of the red corpuscles of human blood, and Kölliker asserted that ninety-five per cent. of these corpuscles are of the same size. (By the way, Kölliker also stated that the average diameter of the red corpuscles was 1-300 of a Paris line, *i.e.*, 296 millionths of an inch. Manual of Human Mic. Anat., London, 1860, p. 519.)

Finally, Mr. Editor, let me express my satisfaction that in concluding your article you express your disbelief in the possibility of being able to distinguish human blood "in any particular case with sufficient certainty to swear away a life." With this, at least, I heartily agree, and I may say that it is my intention as soon as practicable to publish such additional details with regard to this matter as I trust will lead to more general acceptance of that sound view.

Very respectfully, your ob't serv't,
J. J. WOODWARD,
Surgeon U. S. Army.

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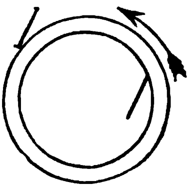
Preparations of Crystals for the Polariscope.

AFTER preparing crystals, dry, in Canada balsam, and in castor oil, it occurred to me to attempt to preserve them in their own mother liquor. To do this paint on a slide a thin ring of gold size, whose entire diameter shall equal that of the cover glass. To make the edges of the ring smooth and true, hold the flat edge of a small chisel against them at the points indicated by the straight lines in the figure, whirling the turn-table in the direction indicated by the arrow. As soon as the ring is finished heat it over the flame of a lamp until it becomes brown. Put into a test tube a little salycine, tartaric acid, prussiate of potash, or other substance adapted for examination with the polariscope, add water and apply heat until the solution is of such strength that crystals will form in it only when quite cold. Coat the ring, already hardened, with a little fresh size, and likewise the edge of the cover glass. Put the slide and cover glass thus prepared, on the hot plate for a few minutes and then pour a few drops of the boiling solution from the test tube into the cell and apply the cover glass, immediately pressing it down gently with a dry cloth which will absorb the superfluous liquid. Touch the edge of the cover glass with gold size and then tranfser to the turn-table and finish. If the above directions have been followed correctly the cell will contain a clear liquid which begins to deposit crystals as it cools. Transfer the slide to the stage of the microscope soon enough to watch this process. Without the aid of the polariscope it is of interest, but with that accessory the spectacle presented is exceedingly beautiful.



After standing for some time, however, the crystals appear to lose their sharpness and perfection of form. They may be restored by a fresh application of heat sufficient to cause them to dissolve and enter upon new forms of combination. As a means of observing the process of crystilization this method appears to be the best, and many of the results as respects brilliancy of color and perfection of outline are unsurpassed. I would recommend, however, that those who have not tried it, should make a moderately strong solution of salycine or tartaric acid in boiling water and pour it over a warmed slide, draining off the greater part immediately. When crystallization ceases put a drop of Canada balsam in the centre of the slide and apply a cover glass. Examine, and if found satisfactory, harden the balsam and finish in the usual way. Having once learned these processes, there is no limit to the range of experiments that may be made. For instance, a strong solution of santonine in chloroform gives very fine crystals which are quite permanent and brilliant when mounted dry. It should be noted that the quantity and strength of the solution employed will modify the results obtained, also agitation of the fluid whilst evaporating will in some instances introduce crystals of an entirely different form from those obtained when it is permitted to remain undisturbed.—*Am. Naturalist.*

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Two of Mr. Adolph Schultze's Contributions to Microscopy Reviewed.

Ed. Am. Jour. Microscopy—It is related by Thackeray, that when he was in this country some one asked him "What do you think of Tupper in England?" and that his reply was, "We *don't* think of Tupper in England."

It would seem that a very considerable class of microscopists "across the water" take much the same view of American Microscopists and their contributions to the science and art of microscopy, that Thackeray did of Tupper, that is, they *don't* think of them at all, but simply ignore them, and, after a longer or shorter interval, take up improvements in apparatus and methods devised here, and coolly announce them as novelties. Mr. Adolph Schultze, of Glasgow, Scotland, appears to be one of these.

For instance, March 6, 1878, he had before the Royal Microscopical Society a paper on "An Easy Method of Resolving the Finest-lined Balsamed Diatomaceous Tests, by transmitted lamplight with special reference to *Amphipleura pellucida.*" This method being the use of Wenham's reflex illuminator as a *direct* illuminator with immersion objectives of very wide angle. This plan Mr. Schultze distinctly announces as a discovery of his own, and quite possibly it was new *to him*, when he stumbled on it. But, had he not been one of those who *don't* think of American work, he might have known that Mr. Samuel Wells, of Boston, Mass., U. S. A., made the same discovery about three years before, as proved by a paper in the Cincinnati *Medical News* for June, 1875, page 288, which gives briefly every item of interest to be found in Mr. Schultze's paper of May, 1878, as republished in the AMERICAN JOURNAL OF MICROSCOPY for February, 1879, page 38, *et seq.* Since the publication of Mr. Wells' paper, the "Wenham reflex" has been constantly and freely used for the resolution of difficult tests, mounted in balsam, by many microscopists in this country, among whom, I may name Mr. Wells, Mr. Tolles, the Spencers, Prof. H. L. Smith, Prof. J. E. Smith, the writer, and others, and an elaborate paper on the subject was published by Prof. J. E. Smith in the Cincinnati *Medical News* for January, 1876.

Now in the AMERICAN JOURNAL OF MICROSCOPY for January, 1880, I find another of Mr. Schultze's contributions (?) to microscopy, viz: "An Easy and Simple Method of resolving the Finest-lined Dry Diatomaceous Tests, mounted on cover, with special reference to Amphipleura Pellucida," the aforesaid easy and simple method proving to be the use of the "Vertical Illuminator," (devised by Prof. H. L. Smith, now of Hobart College, Geneva, N. Y.,) in conjunction with immersion objectives of wide angle.

Now, it so happens that in 1876, I had the pleasure of making the acquaintance of Mr. G. W. Morehouse, of Wayland, N. Y., and at my request, he communicated to the Dunkirk Microscopical Society, of which I was President, and he a corresponding member, a valuable paper on "The Examination of Opaque Objects with High Powers," which was read before the D. M. S., February 23, 1877. In this paper, which was published in the Cincinnati *Medical News* for June, 1877, pp. 284 *et seq.*, Mr. Morehouse describes the very process which Mr. Schultze now offers as new, the form of vertical illuminator used by Mr. Morehouse being Beck's modification. Since then Prof. J. E. Smith has written and published more or less on the same subject, and devised and presented at the reception of the Dunkirk Microscopical Society, held May 22, 1877, the modification, viz: the diaphragm with apertures which Mr. Schultze ascribes to Powell & Lealand. At the reception, aforesaid, Prof. Smith displayed, by means of the vertical illuminator, as modified by himself, and Tolles' duplex objectives, several severe tests, among them Amphipleura pellucida in balsam on the Möller Probe platte, and Nobert's XIX band, dry, (of course), and this too in a public hall crowded with eager visitors moving about from instrument to instrument. A report of this reception was published in the Cincinnati *Medical News* for June, 1877.

Far be it from me to say, that this use of the vertical illuminator was not new to Mr. Schultze when he presented it to the Quekett Microscopical Club last Fall, but he is certainly unfortunate in not making his discoveries till after they have been published two years and more in the United States. That Mr. Morehouse's paper was not entirely unknown in England, is evident from the opening sentence of the paper by Mr. J. W. Stephenson the distinguished Treasurer of the Royal Microscopical Society, which appears in the AMERICAN JOURNAL OF MICROSCOPY for January, 1880, immediately after Mr. Schultze's.

Mr. Stephenson says: "The fellows will have seen in the April number of the *Journal* (of the R. M. S.,) p. 194, a note extracted from the *American Naturalist* for February, in which are described the advantages found by Mr. Morehouse, of New York, to be obtained from the use of the vertical illuminator in the resolution of diatoms and podura scales."

This shows that there are foreign microscopists who *do* think of American workers and work, and also serves to indicate pretty fairly the relative positions of two classes of foreign microscopists.

Verb. sap.

GEO. E. BLACKHAM, M.D., F.R.M.S.

Dunkirk, N. Y., January 21, 1880.

Concerning Scientific Journals.

Ed. Am. Jour. Microscopy—The triple number of this journal, (July, August, September,) containing a letter of mine on the general subject of the best mode of publishing scientific memoirs, with special reference to the duty of this journal in the matter, I only received about the middle of January. To this letter the Editor kindly replied (in same number) in an editorial entitled, "The Aim and Scope of this Journal." I have not been able to see that the objections made by Mr Phin, are of more than limited validity; still, I had thought best to leave the case as it stood, inasmuch as I expected my suggestions to have no immediate effect, if, indeed, they ever attract the notice of men competent to carry them out in anything like a perfect manner. However, a word or two more can do no harm.

The plan of publication above mentioned is, in brief, this: "Let some publisher appoint men in each department to examine whatever articles may be offered." "The publisher must bind himself to publish all writings that are approved by examiners *and in separate form.* To avoid expense of advertising, let a classified list of articles be issued every month, and sent to subscribers for a small sum per annum."

I saw no way of carrying out this plan completely, save by government aid. Recognizing the fact that such aid must long remain a thing of the future, I wrote: "There is, however, one thing that need not wait for the dull comprehension of publishers or government aid. We have here a journal that, for our purpose can be made to rank high above any other microscopical journal that has ever existed." "This purpose is to have this journal take the place of the 'classified list,' above mentioned, its publisher being the one who undertakes to publish all such approved matters (in Biology) *as would sell in sufficient quantity*, and in separate form; i.e., each article by itself." "If the journal be sent, for a time, free to all the libraries of the world that are of sufficient importance, and to a few of the more prominent Biologists of Europe, until it becomes everywhere well known that through it alone can one know what is being done by American investigators, and from it alone can the results of such investigation be obtained without paying for undesired matter, it cannot fail to happen that the journal will secure a greatly increased circulation, authors a greater number of readers, and readers a very great deal of matter that, with the present system, they cannot afford to buy."

In saying that by this plan, "Authors would secure a greater number of readers," I did not have in mind ordinary readers, i.e., those who read for the pleasure of the moment; but men of science. A scientist cares, or ought to care, but little whether his work be read by non-scientists or not. (By scientist I mean here one whose efforts are directed to the advancement of science by means of original research.) Of course the actual number of readers might be greater on periodical plan, (especially if periodical have a popular character,) than could be obtained otherwise, but a large number of them may be just equal to zero.

In the editorial above mentioned, Mr. Phin writes: "The expense of printing 100 copies of a paper is very nearly as great as that of 250, and where the illustrations are numerous and elaborate, the cost is almost prohibitory, if only the smaller number can be disposed of."

The reply to this will be found in my former letter, and is reprinted above in italics, "such matter as would sell in *sufficient* quantity." Of course I would not ask a man to publish a work, large or small, by which he is to lose money; if for no other reason than that it would be useless. I mentioned the number 200 merely for the sake of getting some sort of an idea as to what number of buyers would be necessary to enable one to publish a memoir "of given length with a few cuts."

Far from being conclusive, the objection above is very encouraging. From it I must infer, that even "where the illustrations are numerous and elaborate," a memoir could certainly be sold at a reasonable price to 250 buyers.

I believe that, in many cases, there is no need of such "elaborate" illustrations as are common. Take, for instance, the work of Stein on the Flagellata, (Der Organismus d. Infusionsthiere Bd. III,) of which the first volume only is out, (so far as I know,) and which costs nearly $20.00 in Germany. This price is made necessary I think, not so much on account of the limited number of buyers, (it is a book that will continue to sell long after the youngest of us are dead,) but because of the great number of engravings, all of which are superb and therefore expensive. I cannot but think that this work would have been very nearly, if not quite as valuable to science, if only one member of each family had been represented in the most perfect manner, leaving the great majority of species to be content with cheap diagrams. One species of a family, (if this be rightly formed), perfectly represented, is a perfect representation of all, so far as they are alike; and since the points of unlikeness are, by hypothesis, few in number, they can be brought out quite as well, and very much cheaper, by means of diagrams in the text. Thus is secured also the considerable advantage of not having continually to refer to plates at a distance from the text that is being read. Some one may say that such theories are well enough, but found wanting when put to use. Let him examine the plates in works similar to the one mentioned, or in almost any elaborate biological memoir, notice how great an amount of costly work is done over and over again to no good. How foolish, for instance, to show, in all details, the whole of a Heliozoan, when half would do as well.

There is no denying the fact that the vanity of the investigator is often at war with his real love of science and desire for *its* advancement.

Throughout all Germany and Austria, there is scarcely a scientist worthy the name, who does not read English readily, and whose scientific reading is not made up largely of English memoirs. Without doubt the same is true of France and other continental countries. How great, therefore, would be the mistake of the publisher who, in estimating the probable sale of a memoir, should take into consideration only England and America. Perhaps the "distinguished naturalist," mentioned by Mr. Phin, "who has had in his portfolio, for some years, a work of great value," has not been able to find a publisher who would take steps to secure a foreign market for the book. Nothing, however, could be easier; it is only necessary in the case of Germany and Zoology, to send a copy to the editor of the *Zool. Anzeiger*, and soon every one interested will know of its existence and something of its merits.

Herein lies one difficulty. Publishers, some of them, do not know enough of these matters to form an opinion, and those who might know have other work to do, to say nothing of lack of capital.

Mr. Phin writes: "A practical remedy will lie in the multiplication of special journals." "We want a journal of Botany, Zoology," etc. The editor will excuse my saying that this is only an approach to a remedy. I admit that the more restricted the scope of a journal the better, but had there never been journals of any other sort than such as were devoted to the most special objects possible for them to have and yet live, we would still be in trouble. If I am investigating the causes of diatom motion, I do not, therefore, desire to take a diatom journal. There are many of the best scientists who do not study organisms *in groups*, attempting to perfect the history of any particular order or class; but who prefer to attack general problems, morphological, physiological and embryological, ransacking perhaps a whole kingdom in their search after laws of causation and co-existence. As an inferior example, I may mention the fine essay of Strassburger on Zoospores, "Wirkung d. Lichtes auf Schwärmsporen."

The investigator, as such, desires to read everything upon his subject, and nothing else; if he has to buy this matter in journal form, he will buy much that is of no use to him, and which, if read, will amount to so much time wasted.

In my former letter, Prof. Hertwig's name was spelled Herting. I see a similar mistake in Dr. Carpenter's Work on the Microscope, p. 468, (5th edition,) where it is spelled "Hartwig." W. G. Lapham.

Northville, Mich., Feb. 1. 1880.

Volume I. Out of Print.

We regret to be obliged to announce that Volume One of the American Journal of Microscopy is out of print, and can no longer be furnished to clubs.

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We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II and III, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the **American Journal of Microscopy**. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

New Societies.

ONE of the most gratifying evidences of the hold which microscopy is taking upon the people of this country, is the number of new societies which have been organized. Some of these new societies rival and even outstrip most of the old ones. Thus the Rochester Society, numbers over one hundred members, being, we believe, the most numerous society in the country. The new society at Camden, N. J., also shows a degree of activity which might well be imitated by older organizations.

Amongst the most recent additions to the sisterhood of societies is that of Lancaster, Pa., the first report from which will be found in another column. We see that they limit their membership to twenty-five, a rule which we cannot commend. All such societies should open their doors as widely as possible, and the more members there are the better. It is true, that some individuals will be found in every community who will try to use these societies for their own aggrandisement, but it will always be found impossible to keep them out, since the activity which is born of selfishness is usually of the most vigorous kind. The true plan is to enlarge the society until their influence is proportionately small.

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Held Over.

BESIDES several interesting and important general articles, we have been obliged to hold over some valuable correspondence, and several columns of Transactions. Amongst the latter, will be found an extended report from San Francisco, and an excellent paper on the preparation of diatoms, read by Mr. E. Griffith, of Fairport, before the Detroit Microscopical Society.

Omission.

THE following note was omitted by the printer, and should have appeared at foot of page 55, being referred to the sentence in italics in lines 16, 17 and 18, second column:

> * This character places this species in the genus Agenor of Bisso, (Thorell Ann. and Mag. of Nat. Hist., vol. 18.)

Our Book Table.

The American Naturalist: Devoted to the Natural Sciences in their Widest Sense. Edited by Prof. A. S. Packard, Jr., and E. D. Cope. Monthly, $4 per year. Philadelphia: McCalla & Stavely.

A little over a year ago, it was alleged as a reason for starting a new quarterly journal, (which, by the way, suspended after issuing just four numbers) that there was no American journal in which workers in Natural History could present their results, and that they were compelled to go abroad in order to find a medium for publication!! This statement was forcibly recalled to mind, by the appearance of the February number of the *American Naturalist*, which, with *Silliman's Journal* and one or two others, very effectively contradicts the impudent assertion above quoted. The present number contains four important articles, two of which, (that on "Comparative Embryology" and the one on "The Development of Moina,") are specially interesting to microscopists. Under the sub-heads of Recent Literature, Botany, Zoology, Anthropology, Geology & Palæontology, Geography & Travels, and Microscopy, the reader is kept *au courant* with the scientific progress of the day. The *American Naturalist* is neatly got up, well printed, handsomely illustrated and very carefully edited, and while it maintains its present position, no American worker can, with honesty, assert that he is without a medium through which his results may be presented to the public, and no American student can fairly complain, that he has not within his reach, a record of progress in natural history.

Illustrations of the Nests and Eggs of the Birds of Ohio. With Text. By Genevieve E. Jones and Eliza J. Schulze. Folio. Published by the Authors. Circleville, Ohio.

We have not seen this work, but we desire to call the attention of our readers to it, because, those in whose opinion we have confidence, regard it as specially worthy of the attention of all who are interested either in objects of beauty, or in nests and eggs, as a department of ornithology. As mere parlor ornaments, these plates are far above the meaningless trash which every season sees poured out by publishers who pander to the tastes of those who have more money than brains. A very sad circumstance connected with the publication of this work is, that one of the authors, Miss Jones, died last August, of a fever brought on, no doubt, by her exertions in a work which to her was one of love. Her friend and fellow worker, has, however, determined to carry out the original design, Miss Jones' name being still associated with it. Let us lend all the assistance and encouragement that we can.

The Raindrop. A Monthly Miscellany of entertaing reading for Young People. Published at the Western Pennsylvania Institution for the Deaf and Dumb, Turtle Creek, Penn. $1.00 per. year.

This is one of the most delightful little magazines that comes to our table. It contains a large number of classical stories, told in such simple language that even a child can understand them, while at the same time, they will be found fresh and interesting to all except old book worms. This little magazine ought to be better known. Send ten cents for a specimen copy, and see how much pleasure you can give the little folks.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Rochester Microscopical Society.—The regular monthly meeting was held Thursday, February 9, in the lecture room of the Free Academy, President Lattimore in the chair. The minutes of the previous meeting were read by Secretary Line, and approved.

The paper of the evening was then read by Ed. Bausch, the subject being "The Microscope and its Parts." [This paper we give in full on another page of this issue of the journal. ED. A. J. OF M.]

Discussion of the paper was opened by Dr. Rider, who said, that judging from the human eye penetration in an objective was not a great fault.

Dr. Blackham said that what is called penetration in a high power is a fault. If penetration is desired, an objective of low power should be used. Definition is what is required of a high power objective, and not penetration.

A letter was read on the subject of securing infusoria in water. The plan suggested was carefully exhausting the water by means of a small sponge inclosed in silk. After the sponge is saturated, a slight pressure expelling a little water, should be used before removing from the glass, so that none of the organisms shall adhere to the silk.

President Lattimore spoke of removing the water containing infusoria by means of a syphon made with a muslin strainer drawn over a funnel, and a small rubber tube.

Mr. Merriman, chairman of the committee on revision of the constitution and by-laws, reported. After various amendments the report was adopted, and the constitution and by-laws were ordered printed, with the names of members.

Dr. Sumner announced the death of Dr. Willard Doolittle, and moved that a page of the minutes of the Society be set apart to his memory. Carried.

Dr. Blackham presented a register of objectives to the Society.

The following new members were chosen: Mrs. George W. Elliott, Dr. F. A. Mandeville, and Miss Kate G. Davis.

The paper for next meeting will be by H. F. Atwood. The names of ten members were read from the alphabetical list of members to exhibit objects at the next meeting.

After adjournment objects were exhibited by the following gentlemen: Messrs. Dransfield, French, Atwood and Banker. One of the most beautiful objects was a crystalised tear.

Microscopical Society of Camden, N. J.—Regular Meeting Thursday evening, January 22, at the room of the Society. Walter M. James, M. D., of Philadelphia, delivered a lecture, which, notwithstanding the unpleasant weather, was largely attended. The doctor opened his lecture by a description of the various kinds of dust, the sources whence they originate, and the important part dust plays in the diffusion of light, citing the well-known fact that a ray of sunlight entering a darkened room through a chink or crevice, would be invisible from a side view were it not for the infinitesimal particles of dust floating in the atmosphere, as light travels only in straight lines, and unless the eyes directly opposed its rays its presence would be unperceived. Much of the dust we see in the air is composed of the pollen of plants being wafted abroad to fulfill its mission in the propagation of its species, and frequently gives rise to diseases of the human system which prevail in the Autumn, especially those called coryza or hay asthma, hay fever, etc., which are now believed to be produced by the pollen of various indigenous plants, the rag weed, etc. Not only pollens, but many seeds of plant are provided by nature with appliances to facilitate their dispersion over vast distances, and persons remote from the localities in which the plants abound are thereby affected. A familiar example in the case of seeds is afforded in the dandelion and nettle, the latter frequently rising high in the air and glistening in the sunlight like shooting stars.

Dr. James delighted his audience, not only by the masterly manner in which he handled his subject, but also by the care with which he chose appropriate language in which to clothe his ideas; speaking from meagre short-hand notes it was rather conversational than studied, and seemed to be addressed directly to each individual with ease and fluency. The various moulds were exhibited under the finest instruments of the members of the Society, and the curious branching of the "Penicillium glaucum," the cells of the yeast plant, Vibriones, and various pollens were well and clearly shown by Messrs. Brown, De LaCour, Kain and Derousse, with high powers.

Regular Meeting February 5, 1880. There was a large turn out of the members and their friends. The room presented an exceedingly cheerful appearance, which communicated itself to all present, and assisted in making the proceedings unusually enjoyable.

Aaron Vangelder and Joseph S. Campbell were elected contributing members, and applications from three other persons were received.

Since the last regular meeting the Society has received some valuable donations in the shape of a series of 12 photographs, appropriately framed, illustrating the resolution of some of the most difficult Diatoms, Moller's Typen Platte and Nobert's Bands, from Mr. A. W. Vail, of Philadelphia, a member, and another lot consisting of twenty-two, from Surgeon and Brevt. Lt. Col. J. J. Woodward, U. S. A. Medical Museum, at Washington, through the personal efforts of L. T. Derousse, Esq., Treasurer of the Society. These pictures are of great interest to working microscopists, as they contain a complete history of the objective employed, the name of the maker, power, and whether resolved by oblique or central light. The difficulty frequently experienced in obtaining a view of the markings upon the frustule of the Diatom, is well known to the craft, and will be appreciated by the non-scientific when we inform them that the object itself, particularly the Amphipleura Pellucida, is invisible to the unaided eye, yet the microscope reveals lines upon its surface of such exceeding fineness that one hundred and two thousand are contained within the space of a single inch. The objects photographed are therefore mainly what are called "test diatoms," and are variously magnified from 800 to 4,500 diameters showing these lines perfectly, often both transverse and perpendicular, giving the appearance of dots in regular order.

Votes of thanks were ordered to be sent to these gentlemen for their appropriate and generous gift.

The following recommendations of the President in his annual address were discussed and adopted:

Meetings of the Society to be held semi-monthly on the first and third Thursday, the first for business and third for scientific purposes.

The appointment of standing committees on Botany, Mineralogy, Entomology, and Ornithology, to whom objects in their class shall be referred to be reported on and arranged for preservation and study.

Several others were passed upon relating to the government and comfort of the Society, of no special interest but to the members.

Mr. Sidle, of the firm of Poalk & Sidle, Microscope manufacturers, both of whom were present, gave a clear discription of the latest instrument of their make, "The Acme," which, as its name implies, leaves very little more to be desired, either in the way of merit or cost, and which must commend itself to all workers for its ingenious construction.

An eager and studious audience surrounded Prof. C. Henry Kain, at the close of business, to witness his illustration of some of the latest and most approved methods of mounting objects, the first of a series to be followed out by other members at subsequent meetings. The Prof. had his table strewn with the necessary appliances and materials, and prepared a number of beautiful slides, explaining the process the while, and answering all queries propounded as to the various steps of the process. The Society contains no more expert manipulator than Mr. Kain, as his specimens will attest, and the demand upon him for exchanges from abroad rapidly depletes his cabinet of his own work.

Wellesley College Microscopical Society.—The Microscopical Society of Wellesley College was organized in May, 1877, with six members and three microscopes. There are now forty active members, with a large microscopical library, general and special, and the leading journals on the table; also, sixty-five microscopes and a variety of accessory apparatus at command.

Regular meetings are held on the second Monday evening of each month during the college year.

The officers are, Ida J. Brown, Pres.; Mary I Beattie, Vice-Pres.; Ellen A. G. Page, Rec. Sec.; Ada I. Ayer, Cor. Sec.

The regular meeting was held on Monday evening, February 9; the President, Miss Brown, in the chair.

The leading paper was by Miss Freeman, on the method of mapping absorption spectra with the bright-line micrometer of the Sorby-Browning Microspectroscope. The instrument was described in detail, and the method of constructing a scale of reference by obtaining the position of the principle Fraunhofer lines. The bands in the spectra of different substances are mapped out on the same scale, and thus compared. The paper gave details of the work of the writer, especially in the spectra of chlorophyll.

Miss Whitney called attention to the contents of the late journals, and read interesting extracts.

Some thirty varieties of ferns, mounted for the Society's collection by Miss Painter, were exhibited, and called out much admiration. Several of the slides under the microscope were accompanied by drawings in detail, as the Aspidium spinulosum, Dicksonia punctilobula, Davallia pyxidata, and Cibrotium Schiedii.

The absorption spectra of two preparations of chlorophyll were exhibited under the microspectroscope. Ada I. Ayer, Cor. Secretary.

Microscopy and Medicine.—The Iowa State Medical Society convened at Des Moines on January 27, 1880.

A few medical men interested in microscopy brought their microscopes and exhibited histological objects, which were changed every session. Most of the members were interested in the matter.

At the close of the morning session of the second day, a Microscopical Section was formed by electing Prof. J. J. M. Augear, M. D., as President, and Prof. W. D. Middleton, M. D., as Secretary.

Lancaster (Pa.) Microscopical Society.—This society was organized Feb. 9. Having limited its active membership to twenty-five, at the first stated meeting the ranks were filled. Dr. J. W. Crumbaugh is president, and a considerable percentage of the members are professional men, representing law, medicine and divinity, while the balance come from all branches of business, from a common interest in science. For purposes of illustration, the Society has ordered a fine oxy-hydrogen lantern, with microscopic projector, by aid of which they and their friends will receive instruction.

The New Jersey State Microscopical Society.—This Society met in Rutger's College, New Brunswick, New Jersey, January 19. The meeting was mainly occupied with the discussion of the new by-laws. The secretary gave an account of a weed brought to him by a farmer of Freehold, N. J., which, although set down as rare, in the Botanies, he said was now troublesome. This was the *Lepidium campestre*, one of the *cruciferæ*. It had become at last acclimated. The flowers of this weed are very minute, and the pollen exceedingly small, in fact utterly invisible to the naked eye. At the time when the farmer brought it to him, the secretary was just coming out of a long attack of hay fever. Forgetful of this, and from the sheer force of habit, he put the weed to his nose, and smelt, thus inhaling the pollen dust, when of a sudden the symptoms of the disease returned in full force. In regard to the relation of pollen to this disease, he mentioned his own experience with the pollen of the rag weed, *Ambrosia artemisiafolia*, as having caused a relapse in one instance. He broached the theory that the smaller the pollen the more irritant it was, as being the more adhesive, and the more difficult to detach from the mucous membrane. There was but little time for exhibiting slides, and the Society adjourned.

The New Jersey State Microscopical Society met in the usual place, February 16. There was a large attendance, the most important business being the election of three trustees, and the final action necessary to the incorporation of the Society. The trustees elect were Prof. F. C. Van Dycke, Dr. Clifford Morrogh, and Rev. Samuel Lockwood, Ph. D. The last-named was also elected treasurer. The preliminaries to incorporation being settled, the Society went into exhibition of slides. Dr. Williamson exhibited a mount of flowers, and pollen of *Statice Limonium*. Dr. Baldwin showed preparations of malpighian tufts from kidney of cat, and the human, also *gastric tubules* from the human. Dr. Lockwood showed pubescence on leaves of *Malvastrum coccineum*, from Colorado and Utah. He said the specimens were furnished him by Mr. Marcus E. Jones, of Salt Lake City. The hairs were very irregular and quite pretty, having, many of them, ten radiating lines. This is the plant reported to have poisoned 1,200 sheep in one flock in Colorado.

S. Lockwood, Secretary.

QUESTIONS AND ANSWERS.

We invite inquiries from our subscribers, and such questions as we ourselves cannot answer, will probably draw out a reply from some one of our numerous readers. It has been well said that "everybody is wiser than anybody," and therefore it is probable that most questions capable of solution will receive an answer. It will be observed that all letters, whether of inquiry or answer, are numbered consecutively—the answers having in addition, but in parenthesis, the number of the letter containing the question. In this way it is easy to refer to any letter, either of inquiry or answer, and correspondents are requested to use these numbers in referring to previous communications.

Questions.

1. Can you give me the formula of the standard "Society Screw"? I have heard that another and a larger screw has recently been introduced; can you give me the formula for it, and can you tell me by whose authority it was introduced?

Amateur.

2. I have a silver parabolic reflector which used to give most brilliant effects when it was new and bright, but lately it has become tarnished and black. I am afraid to scour it lest I should destroy its polish; how can I restore it?

E. N.

3. How can I restore the surface of a lens that has been scratched? C. P.

4. Would not an article on "Ascertaining the Magnifying Power of Object-glasses" be of general interest to the readers of the Journal. Beale's statement in "How to Work With the Microscope," page 44, par. 63, seems indefinite. He says: "Suppose I wish to know how much a French quarter magnifies." If his rule applies to all object-glasses, why not say so. His scale is placed ten inches below the eye-piece. We are to infer, I presume, that ten inches is the ascertained distance, under all circumstances, to place the scale below the eye-piece. He continues: "If the magnified one-thousandth of an inch covered one inch, the thousandth of an inch must have been magnified 1,000 times; but in this case it only corresponds to the one-fifth of an inch, and therefore the one-thousandth is magnified 200 times." I think Beale's information on this point fails to satisfy novices, while experts probably have no use for it. E. S.

Answers.

5. (2.) Your reflector may be polished by using a very soft and *clean* cotton bob or buff, revolving rapidly and charged with very fine polishing powder. The best polishing powder is the finest and softest jeweller's rouge; hard rouge will scratch. Another good polishing powder is prepared (not precipitated) chalk or whiting. If you can find a maker of watch-cases, however, he can polish your reflector for you in two minutes far better than you can do it, and without any risk. If you cannot do better, fix a wad of cotton on a spindle driven by the winding apparatus of a sewing machine. We have used such an extemporized buff with good results.

6. (4.) Beale's rule is accurate, but, as you say, indefinite. It applies to all object-glasses, but one difficulty is that while Beale speaks only of the magnifying power of a French quarter, his process embodies three distinct elements, viz.: the power of the eye-piece and the length of the body. We shall give, at an early day, a simple and thorough article on this subject.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. Exchanges only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Pleurosigmas and many other diatoms, marine algæ, and much miscellaneous material, in exchange for good mounted objects; correspondence invited. M. R. Booth, Longmeadow, Mass.

Well-mounted slides of human pathological specimens, viz.: Sarcoma, carcinoma, fibroma, and epithelioma, several varieties of each, also lung in pneumonia, kidney in Bright's disease, for other well-mounted pathological or histological slides; send for list. Henry Froehling, 59 N. Charles Street, Baltimore, Md.

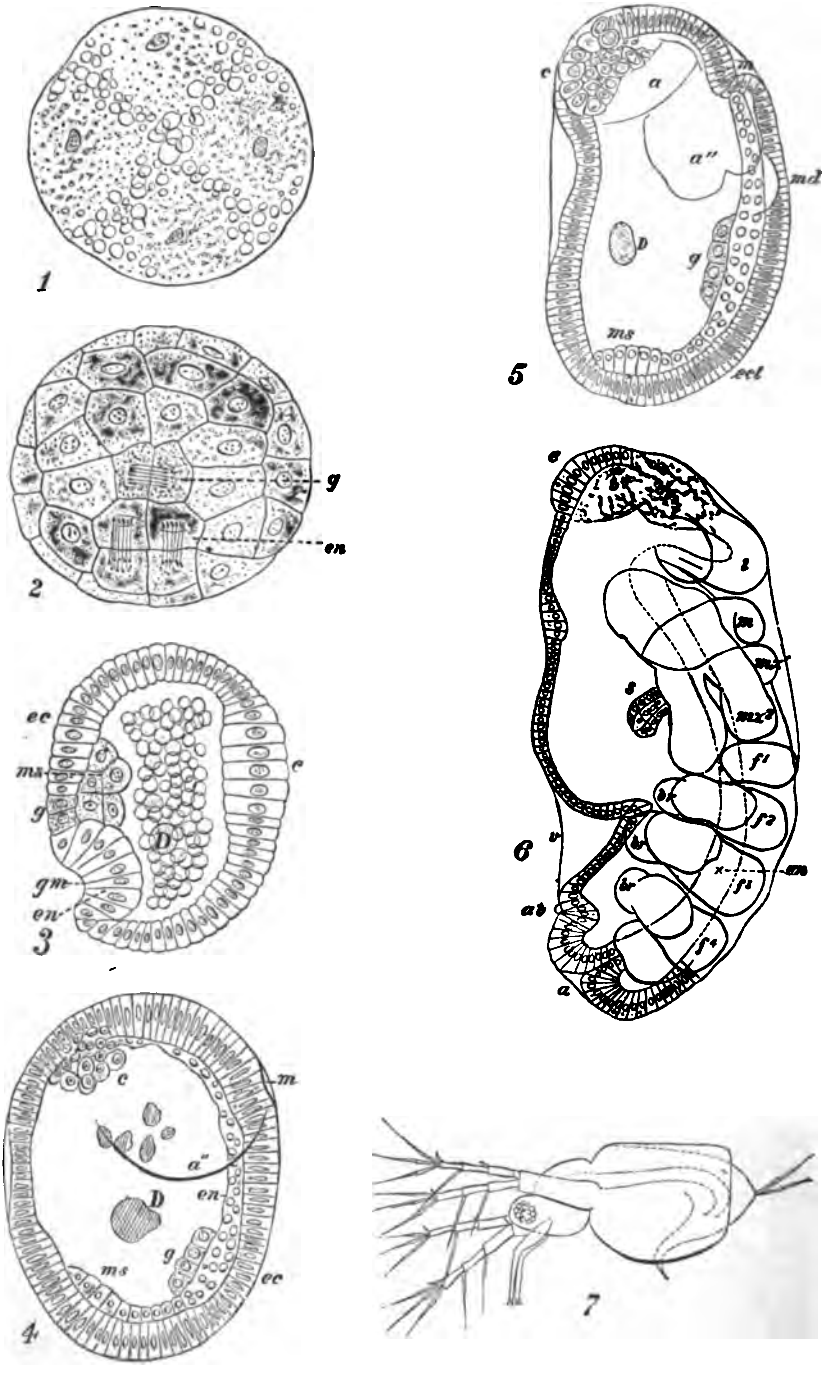
In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

To exchange for a microscope or accessories, a double barrelled breech-loading, laminated, steel barrel shot gun. F. O. Jacobs, Newark, O.

Will exchange selected named diatoms for well-mounted histological, pathological, and anatomical preparations; state what you have and terms of exchange; my preparations all good. W. W. Riner, Greene, Iowa.

Wanted, in exchange for books on the microscope, Schimper's "Synopsis Muscorum Europæorum," and Berkeley's "Handbook of British Mosses." A. C. Stokes, Trenton, N. J.

Exquisite wild seeds, neatly mounted, in sets, by genera and species. Also pollens in balsam, arranged in same way. Rev. J. T. Brownell, Lyons, N. Y.



THE DEVELOPMENT OF MOINA.

THE AMERICAN
Journal of Microscopy,
AND
POPULAR SCIENCE.

VOL. V. NEW YORK, APRIL, 1880. No. 4.

The Development of Moina.*

BY J. S. KINGSLEY

DR. CARL GROBBEN having recently published one of the most complete accounts of the development of one of the Daphnidæ which has yet appeared, an abstract of his paper may prove of value to American naturalists.

The eggs of Moina are oval and measure about one-tenth of a millimetre in length. Segmentation occurs first on the minor and then on the major axis, thus producing four cleavage spheres. A polar view of these is shown in Fig. 1, the food granules (*deutoplasm*) being seen between the blastomeres. Another division produces eight segments, but after this, cleavage takes place at unequal rates in different parts of the egg. As we understand the matter, these cleavage planes do not all pass completely through the yolk. In the resulting mulberry stage the "genital cell" (which afterwards produces the genital system) is differentiated even before the first signs of the gastrula stage. (Fig. 2 *g*, genital cells or the cells which by invagination produce the endoderm. In these cells the so-called *Amphiaster* is shown.) Soon there begins an invagination of the endodermal cells, and other cells arise beneath the ectodermal cells near the genital cells. These form the mesoderm. Others, opposite the genital cells, are larger, and these form the cephalic germinal plate, "scheitel platte." (Fig. 3, an optical section; *ec*, ectoderm; *ms*, mesoderm; *g* genital cells; *g m*, gastrula mouth; *en*, the cells which form the endoderm; *c*, cephalic germinal plate; *D*, deutoplasm.) Then the gastrula mouth closes up, the genital and endodermal cells become internal, the body is constricted and a fold is formed on either side, the first indication of appendages, which develop into the second antennæ. A depression occurs in the ectodermal cells, where finally the mouth appears. (Fig. 4, lettering as before; *a''*, second antennæ; *m*, depression for mouth.) In the next phase two more appendages have budded, the antennulæ and mandibles, while the antennal bud becomes two-lobed. This constitutes the nauplius stage. (Fig. 5, *a'*, antennulæ; *md*, mandible,) Next, two of the thoracic feet are indicated, then two more, the brain begins to appear, the mouth depression is deeper, the anus is indicated and the genital cells divide and are placed on each side of the median line. Then the maxillæ and the fifth pair of feet appear; the eye begins to be developed from the ectodermal cells, the shell gland is present and the abdominal bristles are outlined. (Fig. 6, *b′ b″*, brain; mx^1 mx^2, first and second maxillæ; f^1–f^5, thoracic feet; *br*, branchial sacs; *ab*, abdominal bristles; *a*, anus; *s*, shell gland; *v*, vitelline membrane; other letters as before.) The succeeding changes are those of increase in size of the appendages, in which joints appear, the formation of the shell, appearance of heart and covering of the eye, and at last the animal acquires the perfect form (Fig. 7, from Baird).

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* Die Entwickelungsgeschichte der *Moina rectirostris*. Arbiten aus dem Zoologischen Institute der Universitat. Wien. Tom. 11, 2 heft, 1879, pp. 66, pls. 7.

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Annual Address Before the San Francisco Microscopical Society.

BY H. C. HYDE, ESQ., RETIRING PRESIDENT.

To the Members of the San Francisco Microscopical Society:

GENTLEMEN—Another year has elapsed since I had the honor, as presiding officer of this Society, to make my report of its progress and material prosperity.

During this period, while we have had many pleasant reunions and some interesting and valuable experience, there has not been that active attendance nor the lively interest in its affairs that have characterized some of the previous years of its existence.

This has, I think, been in a large measure caused by the enforced absence of some of our more active members, and I am sorry to have to include the President in that list—but such is the fact; and while his excuses must be accepted as valid—namely: ill health, and consequent thereon, a change of residence into the country—the fact yet remains that the life of any society is exactly proportionate to, and is the sum of, the individual efforts and interest exerted by its members.

I only refer to this subject, and bring it to your attention in this manner, in the hope that you may all see how much is dependent on the efforts of each one to further the interests of the Society, and to urge that if every one of us could be made to feel a sense of obligation to contribute his mite on each occasion, if only by attendance, there would soon be little cause to complain of diminishing interest in the Society's welfare.

During the year we have lost but one member by death, namely, Dr. Oliver Hoff, a resident member, who died on the 24th of December, 1879, in this city.

With respect to our proceedings through the year, I propose to refer to a few of the most important papers and subjects that have been read before us, in all but one instance contributed by members:

THE PHYLLOXERA.

In May, of last year, the subject of the Phylloxera in France, its progress and devastation, was brought before the Society in a most instructive and interesting manner by Mr. Charles A. Wetmore, just from that country, where he had made a special study of the subject. His remarks were illustrated by a map of France, showing the infected districts, and the ravages of that insect year after year, by which it was seen that many of the fairest portions of that vine-producing country, were already overrun with this insect pest, with a prospect of a still further extension of its destructive influences. As a remedy against the spread of the Phylloxera, bi-sulphide of carbon has been strongly recommended in France, and used there with very good results; and in the hope of a successful application of the remedy among our own vine growers in California, Mr. Wetmore provided the Society with a quantity of small cubic blocks of the substance for circulation through the infected districts of this State. They have been widely distributed, with intructious for their use, and it is much to be hoped that good results will follow; but as yet we are without reports, and I presume cannot expect any for some time to come.

In the same month, Mr. J. P. Moore favored us with a paper on the Edible Fungi of California, in which was stated the surprising fact that there were not less than 30 species of edible fungi growing in this State, and fairly accessible to any collector, with a sufficient knowledge of the subject, to determine between the edible and the poisonous species. The indications necessary for this, Mr. Moore undertook to formulate, so as to enable any person of ordinary intelligence to make the selection; but I doubt very much the safety of the process, with the average observer who gets beyond the range of mushroom and toad-stool.

A LARGE FOOD SUPPLY AT OUR DOOR.

It was not alone surprising to know that there existed so large a food supply almost at our very doors, to be had with no more labor than the picking; but it would have enthused an epicure to hear this gentleman's description of the rich and nutritious quality of one fungus, the delicious flavor of another, and the varied methods of preparation of all—roasting, frying, broiling and stewing. Hungry were his hearers for a fungus breakfast, dinner or supper, and promised it was, with the proviso that the host should *prove* every dish, for none of us cared to go through his experience, resembling that of the hired "prover" of a homœopathic dispensary, or the "official taster" under the Maine Liquor Law, even for the laudable purpose of adding to the world's store of foods. There will always be martyrs to science, and among these we fear may some day be numbered our worthy fellow-member. But, joking apart, the fact is a very interesting one, and it might be said valuable, except that, in the present state of intelligence on the subject, the difficulty of determining between a safe and a dangerous fungus is too serious to expect any material addition to our market supplies in that direction. It is a curious circumstance that nature should provide, in a large class of the vegetable kingdom with numerous species, individual species capable of gratifying the palate of man and assimilating with his physical system, while other species, so closely resembling these as to be constantly mistaken for them, and commonly undistinguishable by taste, contain some subtle poison, either deadly or extremely dangerous to the human organization. This, I say, is a singular fact, and furnishes material for useful study—to the chemist, perhaps more than the microscopist; but quite as valuable, I think, as the indentification and determination of numerous species.

In July, Rev. J. H. Wythe, M.D., read before the Socity a paper on certain improvements in microscopical eye-pieces; but as I have not by me his paper, am unable at present to more than allude to it, and to his well known mechanical skill in producing novel optical effects with some very simple apparatus.

METALLIFEROUS VEINS.

Later in the year Mr. Melville Atwood read a paper on the "The importance of a classification of metalliferous veins," which was a valuable addition to the many previous papers of that gentleman on the use of the microscope in mineralogy and geology. He holds that the only way in which mineral lodes can be properly classified, is by their enclosing rocks, or the rock formation in which they occur. For the determination of the greater number of these formations, the use of the microscope is indispensible, their internal structure sometimes differing widely while similar in external appearance. For the purpose of such examination, extremely thin sections are required, and these have been heretofore only obtainable at the expense of a great deal of trouble and patience. Mr. Atwood, as usual, was thoroughly practical, and in this instance explained in theory and practice, with all the necessary apparatus, his method of making the thin sections required. It was extremely simple and so easily acquired that any person could from his description merely, I think, comprehend the whole process.

Some valuable additions have been made to the library during the year, among which may be mentioned McCook's "Agricultural Ants," donated by Mr. Banks, a splendid quarto volume; "The Surgical History of the Rebellion by the United States," through Col. Dr. Woodward; a series of colored charts from Germany, containing large figures of the lower forms of animal life, for wall and lecture illustration, and a book containing the society's stock of mosses and lichens, mounted by our Secretary, Mr. Denison.

It may be remembered that, in my last report, I spoke of the extent and value of our library, and how little its great resources were understood by more than a few of our members, and that I then expressed a hope of being able to properly classify, catalogue and index it. I am happy to be able to say that the hope has been fully realized, although the writer's share in the work has been extremely small, not extending beyond direction and supervision.

It happened that early in the year an opportunity was offered to obtain the services of a gentlemen fully qualified to do the work, and, through the liberality of our worthy Corresponding Secretary, the work was done, occupying a period of nearly four months. The results are presented to you this evening, in the shape of four bound volumes of manuscript, so arranged as to be easy of access, and, I may truly say, of the very greatest value to all students of microscopical science and its allied subjects, inasmuch as we have here a complete index to the *Quarterly Journal of Microscopical Science* and the *Monthly Microscopical Journal;* an index to all subjects connected with microscopy in several other serial publications, including *Nature* and the *Intellectual Observer*, and finally, a full catalogue as well as index of authors and subjects of all the books and pamphlets in our library.

THE ARRANGEMENT OF THE LIBRARY.

This I will describe a little more fully. Bookcase No. 1, containing journals, dictionaries and encyclopedias, has been catalogued on sheets, with name of work and publisher, date and number of volumes. Bookcase No. 2, containing miscellaneous works. These have been catalogued and indexed by cards containing references and cross-references to name of work, subject and author. At least one reference to each work contains, in addition to the above, the name of the publisher, date, edition and size of volume in inches. These cards, after having been alphabetically arranged, were copied into sheets in that order, showing alphabetically separate catalogues of subjects and authors. These sheet catalogues refer to the books by letter and number. For example: A 1, A 2, B 1, B 2, etc., etc. Under each letter are shown all the books numbered under that letter thus indicating the place in the bookcase of each volume. When in the catalogue a work is indexed under A, for example, which is placed among the "B's" in the case, it is referred to thus: "See B," etc. Books that are too high or bulky to go into their proper places in the case, are put on the lower shelf, and in the catalogue are so referred to; these having a special designation, as "XIX 2 X 3." etc. The pamphlets have been put together, on one of the corner shelves, and have been catalogued by cards and written sheets the same as miscellaneous works. Full indices have been made of the following works, written on sheets, viz: "Quarterly Journal of Microscopical Science," volumes 1 to 18, including the transactions of the Royal Microscopical Society. "Monthly Microscopical Journal," including the transactions (to which journal they were transferred), from volume 1 to —. "Quarterly Journal of Microscopical Science," from volume 19 to —. "Student and Intellectual Observer," volumes 1 to 3—on microscopic subjects only. "Intellectual Observer," volumes 1 to — on microscopic subjects only. "Quekett Mic. Soc. Journal," volumes 1 to — full index.

Our cabinet is not in as good a condition as the library. There is a large number of slides, some 4,500, but they need to be classified and catalogued. Among the recent additions were 12 slides of Diatoms from H. P. Atwood, of Chicago; 7 slides of Diatoms, mounted by our Mr. Norris, and deserving especial mention for their excellence, both in quality and appearance; also, 6 slides of minerals from Mr Denison, and 100 slides of Diatoms, constituting the fifth and last century, of Prof. H. L. Smith's series.

THE SOCIETY'S POSITION.

It is a matter of considerable, and I think very just pride, that the position our Society has obtained in the scientific world, has lately been recognized in a marked and very pleasant manner by its proposed, unsolicited, and admission through its presiding officer ex-officio, to a fellowship in the Royal Microscopical Society of London, the oldest, and most honored of all such societies in the world. This was a very graceful compliment to our society, and the connection cannot but be of great advantage to us, if we only choose to make it so.

[The remainder of President Hyde's address consists of remarks on the Annual Exhibition and other matters, a very full account of which has already appeared in our columns, so that it is unnecessary to occupy space with it.—Ed. Am. Jour. Mic.]

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Improvement in Microscopic Eye-Pieces.

BY J. H. WYTHE, M.D.

[In the first volume of this Journal, we published an imperfect description of a form of amplifier, devised by Dr. J. H. Wythe, of San Francisco. This amplifier attracted considerable attention at the time, and Dr. Wythe's claims to originality were freely discussed. The following article which we copy from the *Scientific Press*, and which contains a full and authoritative description of Dr. Wythe's invention, cannot fail to prove interesting to our readers.—Ed. Am. Jour. Mic.]

The magnifying power of microscopic objectives depends on the diameter of the cone of rays at the upper part of the tube of the instrument. As in Fig. 1, the cone of rays from an objective of short focal length is much wider at the base than the cone from one whose focal length is larger, as in Fig. 2.

The diameter of such a cone may be increased by using a concave lens, or meniscus, which produces still greater divergence, as in Fig 3.

If this diverging lens be made achromatic, no injurious effect can happen to the image formed by the objective, save the loss of light consequent on enlargement. Even a non-achromatic concave lens or meniscus may be usefully employed to amplify the image, so that an objective of low power may be made to magnify an object as much as one of shorter focal length. Theoretically, a perfectly achromatic amplifier is needed, but practically, one not achromatic is quite useful. The degree of amplification depends on the concavity of the amplifier, its nearness to the objective, the length of the tube, and the power of the eye-piece used to concentrate and magnify again the image produced.

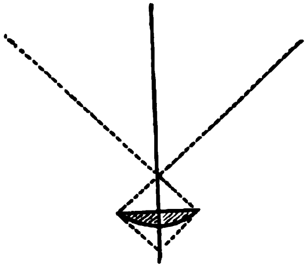

Fig. 1.

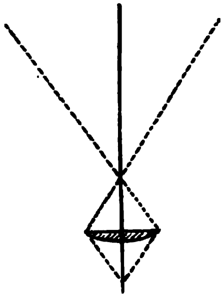

Fig. 2.

The diameter of the microscope tube has an important relation to the distinctness and luminosity of the image. Few tubes are wide enough to utilize more than a small proportion of the rays proceeding from an objective. The field-glass of the eye-piece should be of the greatest diameter possible for its focal length, and the tube wide enough to receive it, in order to concentrate the greatest number of rays from the objective. The short tubes of French and German microscopes are supplied with narrow eye-pieces, which cut the cone of rays nearer the objective and give a more brilliant image than would be possible in a longer tube. If the tube be longer, it must also be wider, and the eye-piece of corresponding diameter.

In considering the construction of the microscope with a view to greater amplification by the eye-piece, it occurred to me that the concave lens or meniscus used to diverge the rays of the objective should form a part of the eye-piece and be of as large diameter as the tube will allow. If it be of small diameter, it must be placed nearer the objective. This is the form and position of the amplifiers of Tolles, Zentmayer and others.

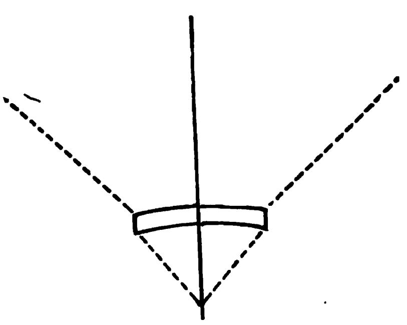

Fig. 3.

One of the amplifiers, exhibited by me to the San Francisco Microscopical Society on a previous occasion, consists of a conical meniscus (Fig. 4), whose position in the tube and effects correspond with the amplifiers above named. With this simple addition placed in the lower end of the draw tube, the magnifying power of an objective can be nearly doubled with little loss of light or of definition.

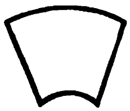

Fig. 4.

The other form of amplifier exhibited is still better. A double concave lens, or meniscus, of as great diameter as the tube will allow and of considerable diverging power, is placed at a distance of from two to four inches in front of the eye-piece. In the improved form in which I now present it, a concave meniscus of six inches equivalent focus and one and a half inches diameter (which formerly served as part of the object-glass of a small telescope, is placed in a draw-tube at the end next the eye-piece and about three inches from the latter. To counteract the aberration of the amplifier, I have sometimes substituted for the plano-convex field glass of the Huyghenian eye-piece a convex meniscus of short focus, which gives also a very wide and flat field of view. Ordinary eye pieces and the periscopic eye-pieces of Gundlach may also be used with the amplifier. The amplifying eye-piece, thus constructed, has given me great satisfaction. If the concave meniscus were made achromatic, it would doubtless be a still further improvement, yet the performance of the eye-piece leaves little to be desired. The wavy, basket-like, longitudinal striæ on *Surirella gemma* and the hexagons on *P. angulatum* are well seen with a one-fourth objective, and the *Frustulia Saxonica* and *A. pellucida* (dry) have been resolved by it with a non-adjusting one-eighth of Gundlach's.

In place of the concave meniscus, referred to, I have also used, with nearly as good effects, a double concave lens of two or three inches equivalent focus, such as can be obtained at an optician's for about 50 cents. So that by a very small cost of time and money, the possessor of an ordinary objective may increase the power of his instrument to a very great degree.

I reiterate the conviction before expressed, that further improvement of the microscope may be looked for in the construction of eye-pieces—regulating their magnifying power and increasing their diameter so as to concentrate rays from the objective, which are now absorbed by the sides of the tube.

On Dark Field Illumination for the Microscope by Means of the Parabolic Condenser.

BY F. H. WENHAM.

NEARLY thirty years have elapsed since the principle of the substage parabolic illuminator was first introduced by me. From its remarkable effects, it soon became established as a necessary adjunct to every complete microscope. The operation depends upon the fact that all rays of light thrown on the object at an angle extending beyond that known as the aperture of the object-glass cannot enter therein; and, consequently, as the source from which the light comes is without the range of the pencil of rays of the objective, the field is quite dark: but if any object possessing a partial opacity is placed in focus, it becomes brilliantly luminous by means of these rays. This illumination is not suitable for very transparent objects, unless there is a great difference in the refraction of the parts, or they are prevaded by air-cells.

One of the most wonderful examples of this is to be seen in the tracheal system of insects. If any of the transparent larvæ of the various kinds of gnat found in any pond in spring-time, be mounted in the elastic gelatine and glycerine jelly (which must be warmed only enough to run, and not kill the insect at the time), at about the third day afterwards all the water is absorbed from the tubes, which then become filled with air. Illuminated with the parabolic condenser, and viewed with the binocular microscope, and a low power, this appears as a most superb and beautiful object. The body of the insect is but faintly visible, but in its place is displayed a most marvellous tracheal skeleton, with every tube standing out in perspective, shining brilliantly, like a structure of burnished silver. Each hair and filament is pervaded with one of these tubes, extending to the extremity. This experiment has always succeeded with me; but unfortunately, I have not been able to discover any method of rendering the objects permanent, for when the whole of the free water becomes dried up, the tracheal tubes either collapse or become filled up with an oil from the body of the insect. A professional mounter of objects might be more successful, and would find a great sale for them.

As the blackness of the field and intense luminosity of the object, depends upon the excess of the degrees of light from the parabola beyond the angle of aperture of the object-glass, as this becomes larger, more of the inner annulus of rays from the paraboloid has to be stopped off, till, at last, with high-angled objectives, it is scarcely possible to obtain a black field, and though this paraboloid may be used equally well for objects in balsam or mounted dry, the utility of its application scarcely extends to object-glasses higher than 1·5th, when these are not of large aperture.

The instrument remained thus till the year 1856, when I described before the Microscopical Society a means by which objectives became "brilliantly illuminated in a jet-black field with an objective of 170° or more." This effect depended upon the principle of causing total internal reflection from the upper surface of the thin glass cover, which thus acted as a speculum for throwing light down upon the underlying objects, immersed in balsam or fluid. Now as no total reflection can occur from rays in passing through the sides of a parallel plate of glass, it became necessary to connect the paraboloid with the cover, by a highly refractive fluid contact, so that rays should not be subjected to the first under refraction, but proceed direct to the top or outer surface, from which they would then be reflected down again, thus inverting the focus of the parabola back into the glass slide. For this purpose I first introduced a nearly hemispherical lens in the cavity of my glass paraboloid, connecting this lens to the slide with water, or preferably "turpentine or oil of cloves," as these being nearer to the refractive power of the glass, cause more rays to be reflected. It will readily be seen that this is tantamount to a flat-topped paraboloid, in fluid contact with the slide—it acts quite as well, as the loss of light by passing through the concentric surfaces is not appreciable; it is the only appliance needed for effectiveness, and is the one fitted to my original microscope. At this same time I made other solid paraboloids with flat tops of smaller size, which are somewhat more convenient in use, if not better in effect.

Some years after this immersion object-glasses came into use. As these are employed with a fluid medium between the front lens and cover, total reflection could no longer be obtained therefrom, as rays that with the dry lens would be reflected down again, now enter the immersion object-glass, utterly preventing the possibility of obtaining a black field on objects mounted in balsam. In the *Monthly Microscopical Journal* for July, 1869, I announced the fact that in using the immersion paraboloid on objects mounted dry, such as the scales of Lepidoptera or Diatoms, if any of these happen to be adherent to the top of the slide instead of on the cover, the top of the slide in dry mounting, then becomes the total reflecting surface, any object adherent thereto prevents total reflection at the spot, and consequently a flood of light escapes through the scale, which appears brilliantly luminous in a black field, with immersion object-glasses of the highest possible angle of aperture.

The immersion paraboloid is chiefly applicable to special investigations, and is not likely to come into such general use as the ordinary parabolic condenser, for on large objects under low powers its effect is not so good, and the use of fluid causes inconvenience.—*English Mechanic.*

Diagnosis of Ringworm of the Head.[*]

I DO not propose to give a general description of the disease, as this may be obtained from many admirable books on the subject. But I cannot help remarking, in the first place, that very few medical men, either in consultation or private practice, are aware how incurable some cases of ringworm are; and the majority consider a case well when it is in a decidedly chronic state. Many boys are presented for admission to Christ's Hospital who, while bringing certificates from medical men of the highest professional standing that they are cured, are still suffering from a severe form of the disease. I have often found, on inquiry, that an opinion has been formed, and a certificate given, without any special examination of the scalp, and certainly without the help of a lens or microscope. Most practitioners imagine that a ringworm is cured when the hair is growing freely and firmly again on the part affected. This is a great mistake, as some of the most chronic cases are those in which the hair has grown again, but, on close inspection with a lens, some scurfiness and *many broken hairs or stumps will be seen scattered among the new hairs on the patches.*

Speaking from experience, after the examination of a very large number of children, I have found that in the majority of cases where a boy or girl has had ringworm on the head within a year or two of my seeing them, the disease is not cured. As a rule, the treatment has been continued until some new hair has made its appearance, after which it has been discontinued, although many diseased stumps remained. Besides the usual cases I have mentioned, where there are numerous broken hairs to be seen on old patches, I sometimes find that the stumps have been rubbed down by friction, or partially removed by attempted epilation, just before the examination. Under these circumstances, we see numerous follicles, with no hairs growing from them—a most suspicious sign—and also some black dots. These black dots are the orifices of diseased follicles, in which the stumps have been broken off on a level with the surface of the scalp by friction, or are the orifices, filled with dirt, left by the retraction of the broken and shortened stump into the follicle after attempted epilation.

Especially would I call attention to a variety I call "disseminated ringworm"—one rarely diagnosed, and the most chronic and difficult to cure. The hair is growing freely and firmly all over the head; there are no patches to be seen now, although probably they have existed at an earlier stage of the disease; the skin appears generally healthy and perhaps almost free from scurf, but numerous isolated stumps, or groups of stumps, are seen in every direction, often scattered all over the scalp. This variety is almost always overlooked, and can only be detected by very careful examination. The stumps in old chronic cases are very brittle, and almost always break on attempted epilation, showing, after soaking some little time in liquor potassæ, under the microscope a most extensive implication with fungus, even down to the root of the hair. Rows upon rows of conidia, like strings of beads, are seen splitting the substance of the hair, and causing it to appear almost double the ordinary size. Where the disease has continued for a year or longer the whole thickness of the hair seems to be filled with these rows of conidia. (*Vide* diagram.) Cases like this have certainly existed for many months, or, more likely, for a year or two, and may have given the disease to many other members of a family, while all the time they have been overlooked or thought to be well.

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[*] By Alder Smith, M.B. Lond., F.R.C.S., Resident Medical Officer at Christ's Hospital. London.

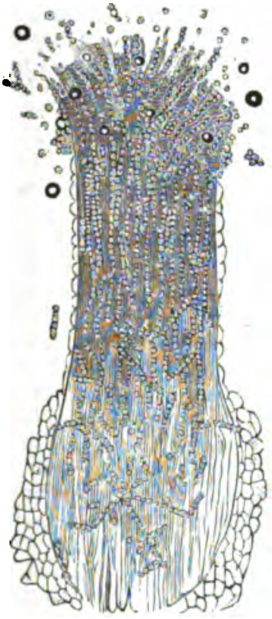

Fig. 1.

A stump, very full of fungus, taken from a case of chronic ringworm, of nearly three years' duration, showing the rows of conidia, even down to the root, and the appearance of the stump where it has been broken off, frayed out, and some oil-globules.

But apart from these varieties, some of which are exceedingly difficult to diagnose, I have had children sent to me, certified as cured, when there were *typical patches* existing as large as a five-shilling piece, itching, and covered with very short, broken, dry, and twisted hairs, often of the usual yellow or ash-grey color, and with fine scurf, evidently showing that some medical men have no idea what ringworm is like; and even when it is explained to them, they affirm that the disease is dried up and cured, and that the child is quite fit to mix with other children.

It is a great mistake to think that ringworm of the scalp usually presents itself as a red spot of a ring-like form, almost destitute of hairs; the appearance of ordinary ringworm of the skin being seldom seen. At an early stage of the disease, there may be only a very small scurfy spot or two, containing hairs more brittle than usual; but as a rule the doctor does not see the case until one or more of the hairs are broken off short. Local scurfiness, without stumps, does not necessarily imply ringworm; but such spots, especially in light-haired children, or if the disease exists in another part of the head, are very suspicious, and must be carefully examined with a lens, and the scurf placed under the microscope. Often a *single* stump will be discovered. General scurfiness or seborrhœa must not be mistaken for ringworm. At other times actual stumps are not seen, but shortened irregular twisted-looking hairs, sometimes lying quite flat on the scalp, and of a lighter color, which, on attempted epilation, break off and show the usual fungus. Chronic ringworm may also occur in the form of pustular spots, with a stump in the centre. This appears to be Nature's effort to get rid of the stump, and can be successfully imitated by treatment. A very chronic form is also often observed, where there are one or more large irregular patches, often extending nearly all over the scalp. The surface is very scurfy, and very many of the long hairs remain, together with numerous stumps. This variety is sometimes mistaken for seborrhœa or eczema, but can always be diagnosed by the stumps. Cases are even found where the entire scalp is affected.

Medical men should not consider a case to be cured, or certify a child to be free from ringworm, unless they have most carefully examined the whole scalp in a good light, and specially looked at any suspicious spot with a lens, and are certain that there is not to be seen a single stump (or even the black dots before mentioned), giving evidence of the fungus under the microscope. Sometimes it is extremely difficult to detect the stumps when only a few exist; and often the attention is directed to the short hairs round a treated patch (caused by the hair having been cut), instead of to the diseased stumps, which are frequently concealed by the healthy hairs, and only protrude about a sixteenth part of an inch. Stumps are often of a lighter color than the rest of the hair, and as long as any remain—and they may exist for years—the disease is not cured, and may continue stationary, or spread again, besides giving the affection to other children.

If all the stumps could be extracted by the roots, the disease might be considered cured; but almost always one or more will break off, allowing the root part, which of course contains the fungus in an active state, to remain behind in the follicle, out of which it will not protrude again for a week or two. It constantly happens that a doctor removes, as he thinks, all the stumps from a patch, and certifies the case to be well. But if the place is watched a few weeks the stump will be sure to appear again; in fact, I consider it *extremely difficult to certify that a child who has had ringworm is absolutely well.* Time after time stumps will crop up here and there, breaking off when an attempt is made to extract them. They may keep on reappearing for months after the case in other respects seems well. Even specialists will be deceived, and after putting a strong caustic on a single patch, and then getting a bald place apparently quite free from stumps, they will certify the case to be well; but after a week or two up come the stumps again, and prove the certificate wrong. Therefore a bald patch should never be considered well until the new downy hair is growing freely, without any stumps. I would also warn against devoting all one's treatment to one or two patches; for while these are being cured, if proper precautions be not taken, other small spots, where the disease has been overlooked in its incipient stage, make their appearance; and the doctor may find when he has cured the first patches, that he has several more to deal with; therefore, the whole scalp should be constantly examined during treatment. Sometimes, when ringworm is cured, especially after the head has been shaved, there are a few *atrophied* stumps seen. These easily come away entire when extracted; they have small atrophied roots, and show no fungus under the microscope, the ends being sharp cut (from shaving) or blunt, and the shaft being of the normal, or less than the normal, thickness.

In old chronic cases the diseased stumps undergo some fatty degeneration, and thus many small oil-globules are seen in and about the stumps, as well as conidia. Again, small oil-globules on a normal hair or atrophied stump must not be mistaken for conidia. To a practiced eye there is no difficulty in diagnosing between atrophied and diseased stumps. The regular, equal-sized, and bead-like arrangement of the bright and circular conidia, with their double contoured outline and nuclear contents on or in the substance of the hair, cannot be mistaken when once seen. Ether will also distinguish oil-globules from conidia by dissolving the former; besides, the fractured, faggot-like appearance of the broken end of the stump is most characteristic.

In diagnosis I place but very little reliance on the fact that the hairs come out easily round a suspicious spot, as they may do so with equal facility all over the head in cases that are not ringworm, and be very firm in obstinate forms of the disease. *A very common error* is to take a long hair close to or from a patch of ringworm, and finding no fungus on it under the microscope, to conclude the disease is cured. It is useless, as a rule, to look for conidia on the long hairs taken from or around a treated patch. The whole attention for diagnosis and prognosis must be paid to the short stumps. I have seen a bald place, purposely made by the hair being pulled out, very much resemble a patch of ringworm, but of course it contained no stumps.

Parents and friends, as a rule, will not credit the diagnosis of chronic cases, nor believe the time the ringworm has existed, and the time it will probably take for its cure. Very many children in private families have this disease without its being suspected. We issue strict instructions that children who have ringworm will not be admitted into Christ's Hospital, and yet the average percentage of boys, during the last five years, that have had the disease unknown to their parents, or thought to be quite well when first brought up for admission, is 8·4.

Ringworm occurs among the rich as well as the poor, and in all parts of the kingdom; but it is especially frequent in the lower classes that attend school. I once examined a school of this class of boys, and found more than half of them had ringworm of the head. Without going into the reasons for its being so, I may remark that it appears that the disease is much more contagious among children under ten years of age than it is among those who are older, and it is rarely contracted after the age of fourteen.—*London Lancet.*

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— Silver wire in which the most delicate test could detect no difference in diameter in any part, has been run through plates of rubies to the length of one hundred and seventy miles.

Diatoms: How to Find and How to Prepare Them.*

A LITTLE experience will enable any one to find and to gather all he may desire. Those living in this city can easily procure many beautiful varieties by simply fastening a muslin bag like an umbrella cover to the hydrant. After securing a quantity of the sediment, empty it into a large fruit jar or other receptacle nearly filled with water, and let it settle.

The green, brown, or fawn colored scum on the surface of pools, bogs and marshes, is mostly diatoms, and it may be taken up by means of a spoon or bottle and preserved, always in alcohol and water, or dried upon paper. The living weeds should be taken carefully from their location without much compressing or washing. The finer water plants yield the richest harvest. Fresh water forms are sometimes found hanging in green-colored masses from drains, sluices and water pipes. To gather from the lake, a net of fine muslin, having an opening in the bottom in which a wide-mouthed vial is tied, may be towed at at the stern of a steamer. The sediment left in the bottom of pails, barrels and other vessels, contain a good supply. To obtain varieties not found at home, open a correspondence with gatherers in other localities, who will gladly exchange. Lake Michigan alone contains probably several hundred kinds.

The process of cleaning diatoms requires time, skill, patience and personal experience, in addition to what may be learned from others. After trying for a long time to dispose of sand and mud the novice will be more careful in collecting. After an explosion or two, involving the loss of valuable material, and possibly the destruction of clothing, he will learn that strong acids and other chemicals are not to be handled like water. Experience makes the process safe and comparatively easy, requiring but a few minutes' attention at a time. No one method will apply in all cases, for some gatherings are imbedded in stone, some cemented with lime, which require special attention, while many gatherings require nothing more than a strong heat to destroy the organic matter and leave them ready for mounting.

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*Extracted from a paper read by E. H. Griffith, Esq., before the Griffith Microscopical Club, of Detroit, Mich.

In recent gatherings, when the diatoms are clean, put them into a bottle containing equal parts of alcohol and water, where they may be kept as long as desired. When ready to transfer them to slides, all that is required with most varieties is to dip a few from the bottle with a pipette and put them on the thin cover glass, and after placing the glass on a strip of mica or of tintype, keep the whole at a red heat until the organic matter is destroyed and only the shells remain in white powder. The favorite method of Lionel S. Beale, the microscopist and author, is to place all diatoms, whether recent or fossil, in a platinum cup, and then keep them at a red heat for several hours, or until the carbonaceous matter disappears, leaving a pure white ash. Dilute nitric acid is then used to dispose of the carbonates, and the remainder is washed.

The following simple method of cleaning diatoms, without acids, I learned of Prof. H. L. Smith, of Hobart College, now president-elect of the American Society of Microscopists: Boil for 30 to 60 minutes in strong soap suds, wash thoroughly in soft water to get rid of foreign material, such as sand, flocculent matter, etc. How to accomplish this will soon be explained. On examination of the material, if organic matter be still present, put the mass into a test tube or other suitable vessel, and, after settling, completely turn off all supernatant water and add four or five times its bulk of nitric acid, and while boiling throw in small fragments of bichromate of potash to bleach. Some prefer chlorate, but the bichromate is sufficient, and danger of explosion is avoided. When the organic matter has been destroyed, a higher temperature will be required to boil the acid, indicating that no more is needed. Probably five or ten minutes will be sufficient. Wash in rain or water from melted ice until a drop evaporated on a slide shows no crystals around the edge, leaving a clean slide of diatoms. Never use hard water, for the lime in it will cause all flocculent matter to cohere in masses.

The methods given are all that is required for a large proportion of diatomaceæous material so far as disposing of organic matter is concerned. The sand and other indestructible matter must be eliminated by gravity.

Guano, Monterey stone, material containing lime, etc., requires harsher treatment and much more time.

Guano should be boiled at least two hours in soft water, or as long as any coloring matter can be turned off; then proceed as in fossil earths.

Stonelike masses must be broken down by boiling in a strong solution of sal soda. After disintegration wash and boil for 20 to 30 minutes in strong nitric acid, and while yet boiling add about an equal quantity of muriatic acid, and continue the boiling from 20 to 30 minutes longer. After washing out the acids boil in pure sulphuric acid until the mass becomes inky black, then throw in fragments of bichromate of potash, and continue the boiling until it becomes clean. If, on examination with the microscope, it is found there is much flocculent matter besides the diatoms and sand, it can be removed by boiling for a few seconds in caustic potash, and then turning almost instantly into plenty of soft water to destroy the action of potash. The diatoms are chemically free from all organic matter, and they may be dried and kept in small phials in powder, or be put into equal parts of alcohol and water, and kept for future separation from sand and other inorganic matter, or we can proceed at once to isolate the diatoms, also to separate into sizes. To do this, put the cleaned diatoms into a small bottle, fill with soft water, filtered, and after shaking thoroughly turn off all that floats after five seconds into a larger bottle. Repeat the process, and after some five or six repetitions we shall find very little but sand in the first bottle, which we will throw away unless some very large diatoms remain, which can be removed by drying on a slide and picking with a mechanical finger. As soon as the material in the large bottle has settled, turn off the water and return the material to the small bottle and repeat the process, allowing longer time to settle. This process may be repeated five or six times, or as many times as necessary to make the separation satisfactory, allowing more time on each repetition to settle. Another excellent method is used by Christian Febiger, of Wilmington, Del., whose arranged slides have attracted much attention. Strain through No. 18 bolting cloth to obtain larger diatoms. The remaining small diatoms and sand must be placed in a clock crystal and rotated. The sand will go to the bottom and the diatoms can be poured off repeatedly until clean as desired.

It will be impossible to save all the diatoms in the repeated washings. So long as 100 slides can be mounted from a mass not so large as a small pea, be content to save time and patience by losing a tithe of the harvest. Do not be disappointed when you find hardly enough diatoms remaining to make a fair thickness of carpet in your phial, for if clean you will have sufficient for yourself and for several of your friends, even then.

For mounting, always place with a pipette a drop of the fluid containing them upon the cover glass, and never on the slide. Prof. Hamilton L. Smith was my teacher in this method, and I know of no other equal to it. Cut a piece of photographer's tintype into strips about one inch wide and three inches long, then cut away all except enough for a handle, leaving one inch square on one end. Bend the end of this handle and fasten into a cork in a bottle, which will serve for a holder. Upon this plate place the clean cover, and by means of a pipette drop a little of the dilute alcohol and diatoms upon it, and apply a gentle heat with a spirit lamp. The alcohol takes fire and burns off. The remaining alcohol causes the diatoms to become evenly distributed. If inclined to mat, touch with a hot pin or needle. Now bring the whole to a red heat for plenty of time to make the diatoms appear white and perfectly clean.

On the centre of the glass slip place a tiny drop of old balsam, and with a pair of tweezers place the cover glass over it and hold the whole over the spirit lamp until a sea of the bubbles is seen underneath. Remove, and with a gentle pressure with a pin place the cover. The bubbles will all disappear and the balsam will become hard. To secure the diatoms all in the same plane turn the cover side down and leave in a warm place.

The process of arranging diatoms is a simple one. The diatoms are picked one by one with a mechanical finger and placed where desired.

To prepare the slide put it on a turn table, and with a pen make a small circle in the centre to guide in placing. On the other side of the ink ring put a tiny drop of pure distilled water, and with a small fragment of gelatine size it, so that when the diatoms are arranged breathing on them will bind them in the size. The best bristle that I have tried to use in the finger was recommended to me by C. M. Vorce, of Cleveland, who has done much excellent work with the microscope and with the mechanical finger. He uses a cat's whisker, and I prefer it in most cases to any other. Prof. H. L. Smith uses a rubber tube with glass tips, through which he breathes gently to dislodge diatoms which adhere closely to the bristle. The breath is to moisten the slide and not to touch the diatoms until held to the slide with the bristle.

A Word for Duplex Objectives of Wide Aperture.

BY ALLEN Y. MOORE.

I HAD almost always used medium and narrow-angled objectives, and when, through the kindness of Prof. J. Edwards Smith, I was supplied with a superb 1-6, of "180°" (100° internal) aperture, made to his order for me, I felt like a small boy with his first pair of boots.

It was claimed that this lens would show all known tests—in fact, its definition was "intense." In Prof. Smith's hands it had shown Nobert's band, balsamed *Amphipleura pellucida* (No. 20 of Möller's plate), etc., by lamplight—using a small hand lamp, and a smoky chimney at that.

When this objective arrived I screwed it on the tube and put a slide of *P. Angulatum* on the stage. I looked through the tube and—what a sight! A ten-dollar lens would have shown better. I began to feel a little "down" at this, and tried other objects, and with but little better success.

I knew very well that the collar would need very close attention, and I began; but I soon found myself sadly at sea, for a wide-angled lens is another and a totally different thing from one of low or medium angle. I had about concluded that the collar was a genuine nuisance. Soon I tried a slide of *S. gemma.* Now, with a 1-6 of 140° I had frequently seen this diatom in dots, and I knew very well that this duplex *ought* to show better than the medium-angled glass. It seems that I got the collar *about* in the right place, for I soon saw the dots with a beauty and *smallness* (absence of coma) that the other 1-6 could not pretend to equal.

Right here I began to get an idea of the use of this collar. Soon I saw No. 18 of Möller's test-plate by sunlight. I studied the effects of the collar, and soon I had a glimpse of the lines of No. 19—then No. 20. I wrote a letter to Prof. Smith and got a reply that started me on the test-plate by lamplight. How well I remember my first attempt. No. 14 (*Nitzschia sigmoidea*) failed to yield; I kept at it though and soon had a fine view of Nos. 18 and 19. No. 20 was a hard one, and required the utmost care in manipulating the collar and light, but it had to come

Now see the difference. At first this lens would hardly work as well as a cheap ¼, but by practice and study it "pans out" beautifully, and is far superior to the medium angled lenses. Right here comes the question which has been asked so many times: Are these lenses better for "real work" than the medium-angled lenses? Well, "real work" ought to be defined before the question is discussed. The real work of one person may be very different from that of another, and yet both may use the same magnifying powers and both want to see all they can. As a fair test for real work I took the contents of a Weber animalcule slide—lively animalcules—*Paramœcea*, etc. The result here was the same as on the test-plate of Möller. I could see more with the duplex than with the other 1-6. The animalcules were shown with that brilliancy and sharpness that only the wide angles yield. Both of these objectives were rated as first class, and the corrections good, so it could not be said that one was a second-class objective.

After a close comparison of these lenses it seems strange that the wide-angled lenses are not universally admitted as better for any and all work. Of course low-angled, non-adjustable objectives have their uses, but not often. I know of one person who owns a fine 1-6, but who uses a cheap French triplet, 1-10—it is easier to "handle." In such hands of course a wide-angled lens is not as good as a narrow one, for the former demands that close attention which is necessary to bring out their good qualities. It pays to devote that extra study and manipulation to these lenses, for the results obtained can not be had in any other way.

Coldwater, Mich., March 17, 1880.

Errors of Refraction in the Eyes of Microscopists.

BY JOHN C. MORGAN, M. D.

It will, I think, be at once admitted that the requirements in construction and adjustment of glasses, and the results of work done, must vary greatly with individualities of the workers' eyes.

One of the most important, but least thought of, is *astigmatism*,* a condition known to oculists as a common cause of occipito-cervical headaches, sometimes so severe as to be considered due to grave hyperæmia of the brain, or to "brain-fag," etc.

This defect consists in a diversity of curvature; hence, of refraction of one meridian of the cornea, as, for instance, the vertical, with another meridian (horizontal). One of these meridians may be "far-sighted," the other "near-sighted," or the difference may be more moderate.

Some slight degree of this is quite common, as many of your readers will discover on viewing a black line at a convenient distance in these and other positions. In one it will look black and sharp; in another, at a right angle, pale, ill defined, and as if the rays were cut off by a longitudinal slit in a diaphragm. Such a slit, turned in various positions, has a curious effect, illustrating the influence of loss of the rays. Astigmatism similarly affects vision; only, in this, dispersion is the immediate cause of loss.

Another and very simple test of astigmatism is "the point of light"—e. g., a gas flame, reduced to its smallest dimensions (of the yellow), when, to a normal eye, across a large room, it appears as a round point; but not so to astigmatic or to other abnormal eyes.

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*From the Greek, *a*, *privative*, and stigma, *a point*—want of focal point.

Dispersion of rays results from imperfect focussing; and the object seems larger in consequence (but less bright). If this dispersion be only in one meridian of the eye (astigmatism), the apparent enlargement will be in *exactly the same position*, and the image will be long, not round, and thus the individual may note the precise angle in which a cylindroid lens must be worn, for "correction," and the restoration of the round image. If this meridian be short-sighted, the cylindroid must be concave; if far-sighted, convex.

The experiment may be varied by using a dark card, with a $\frac{1}{8}$ inch round hole in it; when placed before a window, strongly illuminated, the point of light appears, of course, and it is more accurate in shape than the flame.

One point more. Spasm of the focussing apparatus (called "spasm of accommodation") may derange the sphericity of the eye, and so affect vision. *Strained* vision is liable to this. On the other hand, the same apparatus may be paralyzed, and *ordinary* vision deficient, whilst the focussing of the microscope entirely *corrects* it.

A linear marking, long or short, on a diatom, or a scale, or a cell, must suffer the same variation in divers positions after the passage of the rays through the best glasses. Some of the disputes as to these may be traced, doubtless, to this cause; and probably may be set at rest by the use of *astigmatic spectacles* with the microscope.

These are merely lenses of prescribed cylindrical curvature, whose axis is placed in the position of the abnormal corneal meridian, whereby its curvature is corrected. The general effect is to render the whole cornea practically spherical in form.

Astigmatism has been an injury to painters, as Turner, whose later pictures (the power of accommodation, or self-correction, being lost with age) are discovered to be distorted in consequence; the tendency being to exaggerate the size of the paler dimension in painting it.

On the contrary, in microscopic drawing, as with the camera lucida, the improperly pale line will be perpetuated, and the perspective misrepresented; and distortion of dimensions generally may be perpetrated by the most careful observers, and endless disputes may thus arise. A familiar example of this is shown in the Podura scale (vide Phin's "How to Use the Microscope," pages 62, 63), and sufficiently illustrates what is here meant.*

Philadelphia.

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* By cutting a slit, say one line or less in breadth, and half its length, into the edge of a card, this picture may be made to vary extremely, viewing it in divers positions through the slit.

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A Visit from Dr. Carpenter.

THE announcement that Dr. Carpenter will visit this country during 1880, will give unalloyed pleasure, not only to the great body of physiologists and microscopists, but to the scientific men of the country generally, for Dr. Carpenter is well known as having taken part in a wide range of scientific investigation. And in addition to the respect accorded to his high position as a scientific man, every microscopist in the country will give him a warm welcome on personal grounds, for the clear and genial character of his writings has smoothed the path of many a solitary student.

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The Rochester Alga Club.

THIS club is composed largely—or rather wholly—of microscopists who are devoted to the study of this interesting class of plants. It will be seen by the announcement in our column of Transactions, that though they are an independent organization, they are affiliated with the Rochester Microscopical Society. Such an arrangement will prove advantageous to both parties.

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A Microscopical Society at Syracuse.

IT gives us great pleasure to learn that a society, embracing Onondaga and adjoining counties, was organized at Syracuse on the 6th inst., at a meeting held in pursuance of a call previously issued. The name chosen for the organization was "The Central New York Microscopical Club."

Officers elected for the ensuing year: President, Geo. K. Collins; Vice-Presidents, Alfred Mercer, M.D. and Danl. G. Fort, of Oswego; Secretary, A. L. Woodward; Treasurer, Robert Aberdein, M.D.

Ringing and Finishing Slides.

A GREAT deal may be said in favor of and against the careful finishing of microscopic slides, but nobody will deny that a nicely-ringed preparation looks better in a cabinet, and is better taken care of by its owner and his friends, than one which is not thus embellished, and which shows a greater or less amount of balsam irregularly distributed around the edge of the cover. I will, therefore, jot down a few remarks on the ringing and finishing of slides for the readers of the JOURNAL. After the object has been mounted in balsam and the cover applied, it will be found that there is always a greater or a less surplus of balsam which comes out from under the cover. This should be allowed to dry, and when thoroughly hard it can be scraped off with a knife. If a round cover has been used, the slide is then centered on a turn-table, and the cover cleaned with benzole, which is kept done by dipping a soft linen rag in the benzole and applying the wet place with the forefinger to the centre of the cover glass; the turn-table being revolved, the finger is quickly drawn toward the edge of the cover and the rag removed. One or two such wipings of the cover will be found sufficient to remove all traces of balsam or extraneous dirt. The slide itself may then be wiped also with benzole, and it is then ready for the application of a ring.

The best ringing medium for balsam mounts is dammar dissolved in chloroform, because if it is inclined to run under the cover it will readily mix with the mounting material without leaving a visible trace behind. I find it best to apply the brush to the edge of the cover almost dry, the slide on the turn-table spinning rapidly around, so as to make a track in which the dammar solution will readily flow. The second application is to be made immediately following the first, with the brush full, so that there will be a small drop of solution on the end, which is allowed to touch the edge of the cover without letting the brush itself come in contact with the glass. This is repeated until the ring is built up to the proper size. It should be borne in mind, however, that in drying, the ring of dammar will shrink considerably, and thus it is necessary to make another application after a few hours' drying.

Dammar or balsam dissolved in benzole or benzine is objectionable, because the solution will evaporate too quickly to allow of a proper building up of the ring, and if such is attempted the result will be a ring full of minute air bubbles. White zinc cement, Brunswick black, asphaltum varnish, and other colored cements may be employed to cover the first ring of dammar; but they should never be used alone, as they are sure to run in sooner or later, no matter how hard the balsam may be. I think that the glass-like ring obtained with dammar gives a better appearance to the slide and is more durable than any of the rings made with colored cements.

When glycerine mountings, or objects mounted in a watery medium are to be ringed, it is necessary to first get entirely rid of any glycerine which might be on the cover or slide. To do this I apply a spring clip to the slide, which serves to hold the cover in position after it has been centered, and then wash off the surplus glycerine with a stream of water from a syringe. The slide is then set on end to dry, and a ring of a waterproof cement is applied around the cover. Such a cement may be bought under the name of Bell's cement, the composition of which is a secret. A better and less expensive cement may, however, be made by dissolving 10 grs. of gum ammoniac in 1 oz. of acetic acid (No. 8), and then by adding to this solution 2 drachms of Cox's gelatine. The resulting liquid flows easily from the brush and is waterproof, especially so if, after the ring has set, it is brushed over with a solution of 10 grs. of bichromate of potash in 1 oz. of water. But what especially recommends this cement is its great adhesive power to glass, even if there should be a little glycerine on the edge of the cover. After the gelatine ring is dry, any other cement may be employed to cover it, according to the fancy of the preparer.

When a considerable number of different objects are being prepared at the same time, it is of great importance to be able to tell one from the other, so as finally to label them correctly without subjecting them to a careful microscopical examination. A paper label, under the frequent necessary handling of the slide, becomes soiled, and the writing frequently illegible; while a figure, or even a full label, written with a pen upon the glass slide, will remain intact throughout the manipulations of cleaning and ringing, and at the same time can easily be removed by a little rubbing with a rag dipped in water.

In order to facilitate the finding of slides in a large collection, it is advisable to place the label bearing the name of the object always on the same end, and if two labels are used to place the one with the preparer's name on the right hand, and the other bearing the description of the object on the left.

C. SEILER.

Preparation and Preservation of the Lower Organisms.

M. Raphaël Blanchard, of Paris, referring to the process employed by Koch to preserve and photograph Bacteria,* says † that more than two years ago, he preserved Bacteria in lasting preparations by using with excellent results osmic acid instead of the process of desiccation employed by Koch, which he considers a very bad one.

In a few hours, or two days at the longest, the surface of water in which an organized substance (vegetable or animal tissue, etc.), has been macerated, becomes, as is well known, covered with a slight pellicle composed of a more or less compact mass of Bacteria, enveloped in a hyaline, transparent substance of slight consistence. This membrane is so fragile that the slightest movement or breath which ripples the surface of the water tears it. A tolerably large piece of this membrane can be obtained by carefully introducing into the liquid beneath it a glass slide, and raising it with caution.

If we then add, with a pipette, one or two drops of a concentrated solution of osmic acid (or even a solution of 1 in 100) to the membrane on the slide, it immediately acquires a much greater consistency and can be covered without fear of tearing it. A drop of a solution of violet of methylaniline should be placed at the side of the cover-glass, drawing away the osmic acid by a cigarette-paper on the opposite side. In about half an hour the Bacteria assume a fine violet tint, the fundamental substance remaining colorless; if the impregnation lasts longer the Bacteria assume a deeper hue, and the fundamental substance becomes tinted. We can then replace the violet of methylaniline by glycerine, which does not render the preparation colorless, as Koch says, if we add a small quantity of the violet. A concentrated solution of sulphate of calcium can also be used with advantage to preserve the preparations. M. Blanchard's collection contains preparations made thus in 1876, which are as bright in color as at first.

The violet is not the only aniline color which can be used, but it seems to be more durable than others.

A solution of hæmatoxylin can also be used with advantage. When a "proliferous membrane" (F. A. Pouchet) has been treated with osmic acid, it is left for twenty-four hours under a damp bell-glass, in a watch-glass containing a few drops of hæmatoxylin. There is then formed an iridescence which spoils the clearness of the preparation, but which can be easily removed by repeated washings. The membrane is then mounted in glycerine (with or without the addition of hæmatoxylin), or in a solution of chloride of calcium, and preserves indefinitely a fine violet tint.

If the Bacteria are free in the liquid, the process of mounting them would be exactly the same.

To prepare Infusoria, or any of the lower organisms, osmic acid should be used, but in a strong or even concentrated solution which instantly kills the animalculæ. A group of Vorticella thus fixed will retain their natural form, some of them being completely extended and others more or less retracted. Amœbæ, Rhizopoda, etc., have no time to retract their protoplasmic filaments, and die spread out on the glass in their living aspect.

Ciliated Infusoria do not lose their cilia, and except a slight blackish hue they are in no way modified by the reagent. Some Opalinæ found more than a year ago in the intestine of a Triton have preserved to this day the delicate cilia with which their body is covered.

The contact of the osmic acid must not be prolonged, or the objects will blacken with age. After the animalculæ are covered with the thin glass, a few drops of picro-carmine or hæmatoxylin can be added.

The picro-carmine does not sensibly color Bacteria, but it colors very clearly the nuclear formations contained in the bodies of the Infusoria. After the coloring, glycerine can be added, and the preparation is complete.

In the study of the lower vegetable forms with naked protoplasm, Myxomycetes, for instance, osmic acid and picro-carmine and hæmatoxylin can be equally well used. By the action of osmic acid the currents in the protoplasm of the Myxomycetes are instantly suspended, and in a few instants the protoplasm is sufficiently hardened to make sections possible.

There are certain exceptional cases in which osmic acid has no direct action. A Nematode, for instance, *Anguillula aceti*, can live a long time in a liquid containing osmic acid. In the case of a female the eggs develop and hatch, and the embryos grow at the expense of the mother, until nothing remains of her body but the outer cuticle, which resists all attacks of the acid. When the young Anguillulæ have pierced the cuticle and are free, they swim apparently unharmed by the acid, though they generally die in a few days.

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* See Journ. Royal Mic. Soc., i, 195.

† "Rev. Internat. Sci.," iii. (1879) 245.

A similar example is furnished by the larvæ of the Diptera, *Chironomus plumosus* Linn., which lives in water strongly mixed with osmic acid, owing to its cuticle resisting the acid.—*Jour. Royal Mic. Soc.*

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Separating Forminifera From Sand.

If you throw dried sponge sand into water, slowly, all the foraminifers will sink, and sand will float on the water. A slide dipped under the floating film of grains will bring up only sand. You can safely skim off and throw away all that does not sink with a little stirring. Then the sunken part should be dipped out, about a dessert-spoonful at a time, into a small saucer, and water enough to just fairly cover them put in, and all floating grains stirred down. Then by a circling movement of the hand the foraminifers will be got to the top, and by gradually tipping the saucer and slowing up the movement they can be worked to one edge of the little pile of sand, and thence carefully dipped up with a rubber bulb pipette. In this way they are got almost pure. Only a little sand must be washed at a time, or not all the foraminifers will be got out, and very little water must be used or sand will get mixed with them. Much water moves the light sand, but a shallow wave seems not to stir it, but yet rolls the shells along.—*Am. Naturalist.*

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Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Mr. F. H. Wenham and Angular Aperture.

Ed. Am. Jour. Microscopy.—In the Journal of the London Royal Microscopical Society for December, 1879, p. 984, is published a remarkable note from Mr. Wenham, that was communicated to the Society Oct. 8th, 1879. This paper is extraordinary, for during the long controversy on angular aperture, Mr. W., has been considered the reliable head of one side of the argument, by all supporters and opponents of his position both in Europe and America.

What does he now say? "As statements have been made to the effect that I altogether deny the possibility of obtaining an angle on a balsam mounted object beyond 82°, the following references will show that excepting under certain conditions, I have not made any such assertion. I must, therefore, state positively, that I never held, and do not hold any such opinion." This positive denial, and at this late day, is astounding, and must be a greater surprise to those who pinned their faith on Mr. Wenham's supposed optical knowledge, than to those who had no faith in his theory.

To show that Mr. W. has utterly denied what he now says he never did deny, it is needful to go over *his* references, and some others, and show that even *they* disprove his present disclaimer.

He first quotes, *Quar. Jour. Mic. Science,* vol. iii, 1865, "I describe for the purpose of remedying the loss of aperture on an object in balsam from a dry object glass I describe the adaptation of an additional lens in front," etc., copied in full by Mr. Wenham in the *Monthly Microscopical Journal,* vol. ix, p. 30. "I took a small hemispherical lens of about 1-90th of an inch radius, and cemented it over a selected diatom" etc. Unquestionably Mr. Wenham's backer, Rev. S. L. Brakey, might well say that this is not an objective, "but an optical machine." Mr. Wenham found that this contrivance gave good results. It is surprising that having come so near, that Mr. W. did not think to attach his lens to the objective, instead of *sticking* it to the slide. But if he had done *only* that he would still have obtained no more than 81° or 82°, which is all that can go through the slide, without some attachment below the slide equivalent to Tolles' traverse lens, or Woodward's prism.

To go back to Mr. W's. last, "In vol. v, p. 17, I state that an angle of 82° cannot be exceeded in a dry objective, nor can it be greater on the immersion system, where an interchange of fronts adapts it to both conditions." What does this mean, but just what all parties supposed he meant?

Next he says, "In vol. v, p. 118, the following sentence has been referred to, 'I challenge any one to get through an object glass with the immersion front a greater angle, or any portion of the extraneous rays that would in the other case be reflected, as no object glass can collect image-forming rays beyond this limit.'" "At the top of the same page I show distinctly that this remark applies to a dry lens." The top of that page *shows no such thing.* Did any of Mr. W's. readers suppose that Mr. Wenham was so absurd as to think a dry lens could become an immersion by merely flowing in water? No, the challenge applied has been understood to apply to any and all immersion lenses, however constructed.

"In vol. vi, p. 85, 'I give a series of measurements of the angles of objectives immersed in water, all of which were within the corresponding limit of 82°.'" Mr. Tolles has done the same thing. It has never, I believe, been charged, that any one of Mr. Wenham's make would go beyond the 82°.

"In vol. ix, p. 268, Col. Woodward, having measured the Tolles 1-10th, referred to in the previous controversy, finds its balsam angle only 75°." This is important, as showing Mr. Wenham's method of argument. What Dr. Woodward did find and report, was the balsam angle at *open point* 75°, at *closed* 80°. Mr. W. chooses to quote only what looks most in his favor, and further, *that objective is not the one* or anything like the one that was the *subject of the previous controversy!*

"In vol. ix, p. 273, (1873), there is a memorandum by Prof. Keith, in which he says, 'Mr. W.'s experiments, alluded to in his article in the *Monthly* for January, indicate an explanation, and it seems singular that they did not suggest to him long ago, a method of obtaining what Mr. Tolles has obtained—an objective of large angle, for objects covered in balsam.' Prof. Keith's accompanying diagram exactly explains the principle, and is just the same in effect as that of my additional front lens, of 1855." Now in 1879, Mr. Wenham revives that "wretched adaptation," (Wenham vol. ix, p. 284, 1873,) of his sticking a lens to the top of the slide. He does not say that by that he obtained a greater angular aperture, or that he ever made any measurement of the angle.

"In vol. x, 1873. p. 12, I say, 'I trust that Col. Woodward, having affirmed that the position taken by me is certainly true, for objectives as ordinarily constructed, will allow that this additional lens embodying a deviation from the original question, which was to the effect that there would be no loss of aperture of ordinary objectives by the immersion of the front surface in fluids.'"

This sentence requires much attention. First, it misrepresents the original question. No one has denied the loss of aperture. Mr. Tolles and Col. Woodward have referred to it in almost every paper they have published. The original question was Mr. W's own challenge to get through an [any] immersion objective more angle than through a dry one. It was not the loss of angle, but the possibility of increasing the balsam angle beyond the limit of 82°, which Mr. Wenham pronounced "absurd," and that the claim for having done so showed "ignorance of optical laws."

In vol. viii, p. —, Mr. W. writes, "any one that ignores, or denies, such a definite principle, (Mr. W's principle,) must expect to forfeit all respect for his optical knowledge."

Now that Profs. Abbe, Helmholtz, Newcomb, Keith and Stokes, and Dr. Blackham, since Mr. Tolles' claim was published, have demonstrated that Mr. Tolles is right and Mr. Wenham wrong; that Mr. Tolles' method is in strict accordance with "optical laws," Mr. Wenham retreats to the after thought of objectives of "ordinary construction."

Mr. Wenham now admits, that that extra front lens will admit the ultra rays, but falls back to "ordinary construction," by which he means, if that has any meaning, three-system objectives. But then the question comes up, whose ordinary construction, Becks, Powell & Lealands, Scheick's, Hartnack's, Nachet's, Tolles', or Wenham's? Mr. Tolles never claimed that Mr. Wenham could make an imersion lens that would admit over 82° from a balsam mount, and never named any of those other makers. But he has not only claimed but given the actual measurement of the balsam angle of many of his own make that gave an excess of from 5° to 18° beyond the limit. To which the only reply Mr. W. could make, was to criticise the method of taking the angle, substituting new methods as often as he found the previous one inadequate. This, to show Mr. Wenham's animus, I will now proceed to prove, and to show that objectives of "ordinary construction," i.e., three systems, and some made long before this controversy arose, do give a balsam angle exceeding 82°.

In vol. viii, p. 106, Mr. Tolles gives the angular aperture of 9 objectives, one only being 4-system, all the others 3-system, or his "ordinary" but various "construction" air angles, varying from 147° to 178°; of these, the balsam angle varied from 81° to 97°. This should be enough to dispose of Mr. Wenham's theoretical limit of 82°, but there is a great deal more. The Rev. S. L. Brakey, who backs Mr. Wenham with a profound display of optical knowledge, atempts to disprove Mr. Tolles' measures by the bareface assertion that "Mr. T. cannot be trusted to take an observation correctly!" Vol. viii, page 245, "Again in the same list we find the figures contradicting themselves. We have e.g. two glasses with apertures of 175°, having different angles in water, the first giving 117°, against the smaller angle of 113° for the second." *Both* these results cannot be true, and a lot more of such reasoning, all of which only prove, not that Mr. Tolles is wrong, but the ignorance of his critic as to the capacity of various objectives, an ignorance that might be expected from one who did not know better than to write that "we understand that a one inch objective has 2-systems, and a ¼ inch 3."

Of course, Mr. Tolles does not make objectives for Mr. Brakey to understand. I have had a 4-10th made with 10 lenses and a prism, many one-inch made with 8 lenses. Mr. Brakey could not understand them. To him they are all "optical machines," beyond his comprehension or understanding.

In 1872, (vol. viii, p. 148,) Mr. Tolles sent the now famous 1-10th to Dr. Lawson to show him the balsam angle, stating explicitly "adjust 10½ closed from the open point. I make the angle in balsam 93°, or possibly by sunlight 95°." This objective is one of those that Mr. W. still excludes from attaining an angle in excess of 82°, a three-system of Mr. Tolles' "ordinary construction." This objective was measured in the presence of four Fellows of the Royal Microscopical Society, and the results they reported being so discordant with Mr. Tolles, have been the cause of much controversy since. Mr. W., after being fairly notified of the proper point of adjustment previously, set the collar at the best point, dry, for a Podura Scale! Under this abnormal condition, "he reports the air angle 145°, front in water 91°, in balsam 79°, (vol. ix, p. 29)." This result so at variance with his own, and the absurd method by which it was obtained, caused severe comments from Mr. Tolles and Col. Woodward, which excited Mr. Wenham's ire. When the objective was returned to America, it was sent to Dr. W. to measure. He found the balsam angle 87°.

The objective is yet in existence as an historical relic and memento of Mr. Wenham's skill. Desirious of having some one of these measures verified, I handed it to a friend for measurement by "Abbe's apertometer," (which is* a modification of Tolles' "wretched" semi-cylinder, the progenitor of all the apertometers since devised.) I copy his report:

CHARLESTOWN, Mass., Feb. 12, 1880.

My Dear Mr. Stodder:

I have carefully measured the angle of your 1-10th with the Zeiss-Abbe apertometer, and find its numerical aperture at the highest point to be 1·125, which is equivalent to a balsam angle of 96° 30′, in a medium of 1·50 refraction index, but with a refractive index of 1·525, that of ordinary crown glass would be 93 +. Curiously enough, the greatest angle is not at the extreme closed point for thickest cover, but at a place considerably within that point.

Yours truly,
L. M. WILLIS, M.D.

Thus is Mr. Tolles' statement of the aperture of this three-system objective of 1869 positively confirmed, and the comments of Mr. Brakey and Mr. Wenham, and their statement and assertions about it, utterly refuted, while Mr. Wenham's new position, that only by the addition of the new fourth system, can any aperture beyond 82° be obtained in any objective, is practically disproved, as his theoretical dogmas have long ago been.

Mr. W. now limits the objection to objectives as ordinarily constructed, which must be as he ordinarily constructs them, for it may be presumed that even he does not know how all other makers construct their objectives. Mr. Tolles has told him one way, (vol. vii, p. 115,) "What is intended, is to increase the refraction of the convex surface of the front by sharper convexity, or higher index of refraction or both." Let Mr. Wenham experiment with this instruction, and with Dr. Woodward's and Prof. Keith's exposition of optical laws, then in time he may be able to construct a modern immersion objective. I have now shown why every one has understood that Mr. Wenham "has denied the possibility of obtaining an angle over 82° on a balsam mounted object," and that he still denies it except under the condition of an extra front lens. I have shown that that condition is not an essential one, that an objective with that aperture of 93° has been in his own hands, and either his own want of skill or knowledge prevented him from obtaining the true angle. There are an abundance of other quotations from his writings to be made to the same effect, but this paper is long enough. C. S.

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*On Aug. 22nd, 1871, Mr. Tolles writes to the *Monthly Microscopical Journal*, p. 214, "an object *homogeneously* cemented centrally between the hemispherical lenses a, a′ can be seen from every point of view.* * * For obtainment of extremest angle, however, let this precaution be taken, viz., that balsam be used above the slide and balsam below." Here we have the first suggestion of the principle and name of "homogeneous immersion," since carried into practice by Zeiss, at the suggestion of Mr. Stephenson. Mr. Tolles did not make any homogeneous objectives then, for the want of a suitable medium, balsam being the only thing of suitable index of refraction to be obtained, and that being utterly unfit to apply to lenses for daily use. It was, however, used by Mr. Tolles experimentally.

Current Notes.

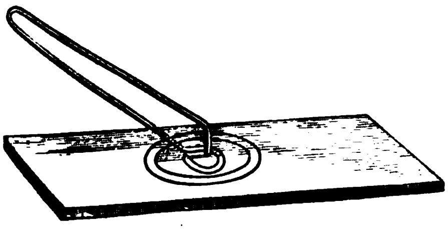
Prof. Zweifel, of Erlangen, believes that catgut sutures may frequently be the unsuspected cause of infection. He found portions of catgut swarming with bacteria, even after it had been ostensibly preserved in carbolic acid. He thinks the decomposition is due to the evaporation of the carbolic acid. He insists that all catgut should be examined by a competent microscopist before being used, to make sure of its purity.

Effect of Low Temperature on Bacteria.—At a meeting of the Academie des Sciences, on December 15th M. Pasteur announced that he had ascertained by recent experiments, that the characteristic infective organism which is the bacteridium of splenic disease, and the infective organism which produces the affection known as cholera of fowls, are both capable of supporting a temperature of 40 degrees Centigrade below zero (40° Fahr.), without losing their faculty of multiplying in culture-fluids or their peculiar virulence as agents of infection.

Clips for Slides.—Buy a bunch of steel-pointed hair pins, size about 2¼ inches in length. With a pair of small round-jawed pliers, bend one point into a ring about ¼ inch in diameter. Bend the other point at right angles with the centre of the ring. Cut off at a suitable length, and you have a most convenient and serviceable clip in almost no time.

J. D. K.

[The following figure will give a very clear idea of the construction of this clip and the method of using it.—Ed. Am. Jour. Microscopy.]



CLIP FOR SLIDES.

The Use of the Cat to Microscopists.—It was practical as well as philanthropic on the part of Dr. Burt G. Wilder to suggest the more extended use of the cat for dissecting purposes. The anatomy of the cat is very much like that of man; the resemblance being closer than that of most other domestic animals. The viscera have nearly the same arrangement; the brain has the primary divisions, and even some of the fissures which are found in man. Most of the cranial nerves may be easily discovered. The bones and many of the muscles can be identified from a knowledge of Gray or Quain alone.

There are many drawbacks to the successful study of anatomy upon the human body. The expense is considerable, the subject may be bad, progress is always slow, and there is, as a rule, very little systematic study in connection with the work. Dissection and examination of the viscera are greatly neglected, and yet they are the most important parts for the majority of students. It is very likely therefore, that preliminary dissections of an animal so easily obtained and cared for as the cat would be of great help to the student. While studying under a preceptor or while pursuing any course of preliminary training he could easily occupy part of his time in such anatomical investigations. He would thus acquire a practical familiarity with the use of the knives, the appearance of the organs and tissues, and the names and general arrangement of most of the structures of the human body. A splendid collection of microscopic slides might be prepared from the cats of any given locality, and not the least of the benefits to be derived from the formation of such a collection, would be the increase of peace and quietness in the neighborhood.

The Eggs in Eels.—Until about twelve months since, it was currently believed that eggs had never been seen in eels, and it was considered quite an interesting discovery when a New England fisherman then discovered them in situ, and also observed specimens of eels both of the male and female sex.

Thus a vexed point which had been discussed for two hundred years, was settled satisfactorily, when, as I understand, Professor Packard confirmed the fisherman's discovery.

Recently, while looking over some papers read before the Royal Society of England, dating very far back, I found that a Mr. Benjamin Allen about the year 1690, read a paper before the society, claiming to have examined two eels, and "found one with egg," and another with "fixed young ones, fastened to very small placentæ each, which was fixed to the intestine." "The eggs were on the outside of the intestine." He also said, "the parts distinguishing the sex are discoverable; those of the male affix to the extremity of the kidney; the female had a slender gland transversely lying near the bowel.

A discussion followed, and a Mr. Dale raised a doubt on account of Mr. Allen's anatomical details being inconsitent with nature, and from the fact of Leuwenhoek finding an uterus in all eels he examined, and also "masculine seed," from whence he conjectured they were Hermaphrodite.

He, however, so far confirmed Mr. Allen on one point, as to state that one Walter Chetwynd, Esq., had in the month of May "found them to be viviparous, by cutting open the red fundaments of the females, from whence the young eels would issue forth alive."

No other member is reported as having spoken on the subject, and so the matter rested.

John Michels.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Microscopical Society of Camden, N. J.—At the regular meeting, Feb. 19, 1880, the paper of the evening was on the hitherto little known Poison, Wourari, which is now being brought forward as a remedy against that dread disease, hydrophobia. Prof. E. F. Moody, the lecturer, described the poison, its source, preparation, and the uses to which it is applied as an arrow poison by the savages of portions of South America, stating that the arrows, intended for use against their foes, were charged to an amount sufficient to cause instant death, while those for the chase contained only a sufficient quantity to paralyze the animal and permit its capture, without penetrating its juices and poisoning its flesh. The effect of Wourari, experimentally used, is found to be the same upon the human subject, paralyzing motor nerves and rendering motion or speech impossible, while the mind remains clear and capable of comprehending all passing events, while entirely incapable of signifying it.

The President exhibited a self-centering turn table, by Sidle & Poalk, of Philadelphia, and explained its workings. Professor Kain also showed a novel method of making glass cells for mounting, and the other members displayed interesting objects under their respective instruments. The meeting was largely attended by visitors, who spent a pleasant evening throughout.

Regular Meeting, March 4, 1880. The Secretary announced his having been in active correspondence with the projectors of a new society recently formed in Lancaster, Pa., and having had a visit from its president, Dr. J. W. Crumbaugh, and Prof. McCaskey. It was ordered that greetings be sent assuring the new society of the cordial interest and sympathy of the Camden microscopists.

Joseph B. Cooper and Howard A. Smith were elected contributors, and Charles H. Austin an active member.

As the time for holding an annual reception is approaching, an interchange of ideas on the subject was in order; and, on motion of Isaac C. Martindale, it was resolved to hold it on or about the 15th of April, and the Secretary was directed to correspond with the other societies and opticians with a view to their participation in the exhibition of instruments and objects. The reception of last year was a gratifying success, and it is expected to largely augment the interest this season.

For the division of labor, and to increase the efficiency of the Society, standing committees have been established on the following subjects.

Botany, Isaac C. Martindale, chairman; Ornithology, R. Bingham, chairman; Entomology, J. L. De LaCour, chairman; Mineralogy, Prof. E. F. Moody, chairman.

Our citizens will do well to remember that specimens are frequently obtained in various localities which are not always accessible, and the various committees will be grateful to have the assistance of the kindly disposed in collecting objects for their respective departments, which can be left with the Secretary, J. L. De LaCour, as being both central and convenient.

The exhibition of the evening consisted mainly of "Pond Life," showing in life slides the rapid evolutions of the various Animalculæ, affording a wonderful entertainment. Prof. C. H. Kain, Stentors, etc.; Chas. Bowden, Vorticellidæ; Louis T. Derousse, Rotifera; J. L. De La Cour, Snail's Eggs and Anguilueæ. The peristomes of Moss, *Eucalyptræ Vulgaris*, brightly illuminated, were also shown by De LaCour, under a simple microscope ingeniously mounted for the purpose, who made some remarks upon their fructification, illustrated by drawings on the board. Phloridzin, a polariscope object, by H. S. Fortiner.

As the advent of an early spring may well be supposed to develop insect life more rapidly than usual, the Secretary would be obliged if persons who have the opportunity to capture the large moths and butterflies of this section will do so carefully, and deliver them alive, if possible, the object being to endeavor to raise the larvæ and take them through the various stages of their existence. The cocoons of the cecropia, ailanthus and sphinx, as well as the insects, will be very acceptable.

Regular Meeting, March 18. Isaac C. Martindale, Esq., entertained the members with a highly interesting essay on "Squashes." Novel as the subject was, it is nevertheless surprising how much of interest the order of plants to which they belong contains. Bentham and Hooker describe 68 genera containing about 340 species, mostly natives of tropical regions, only a few being found in the temperate zones of Europe and America, and affording some of the most delicious and nutritious fruits, as, for instance, the watermelon and cantelope, which are notable examples. A bitter laxative principle pervades the group, unless eliminated by cultivation, and is so concentrated in a few as to render them actually medicinal, the officinal colycynth being prepared from the excessively bitter pulp of *cucumis colocynthis*, and is a powerful drastic purgative. Many species of cucurbits are cultivated for culinary purposes, and others are still characterized as weeds, their uses, if any, not having yet been determined. One of these species, the *echinocystis lobata*, is found abundantly on the Delaware banks, near Bordentown, and the lecturer had noticed it and the "Sicyos," or the single seed cucumber, growing profusely all the way to Colorado, and in the rich bottom lands in Indiana and Illinois, climbing the neighboring trees to a height of over 60 feet, besides matting the adjacent bushes and vegetation into almost impenetrable jungle; so rapid is its growth, that in a single season the vines and its numerous branches, if placed continuously, would have reached a distance of 5,000 feet in some instances; the flow of water through its slender stem is simply astonishing in order to supply the enormous exhalation from the leaves. We look with wonder at the mammoth trees of California, the Sequoia, but not less wonderful are the facts of plant life everywhere about us, and in none more strikingly illustrated than in the growth of the Sicyos. The tendrils of this order attach themselves to such supports as are within reach, and are found only on those plants whose stems are not able to bear the weight imposed upon them by the foliage, flower and fruit. They are possessed on one side of a certain irritability or sensitiveness, which in man is called intelligence, in lower animals instinct, and if touched on the sensitive side bend towards the point of contact and wind closely around the support, coiling upon itself in a double reversed spiral so as to exert the greatest strain upon the support.

The *Ecbalium agresta*, or squirting cucumber, develops in its fruit a curious phenomenon, as when ripe it is easily separated from the stalk by a slight touch, and suddenly expels its seeds and juicy contents through the aperture left by the removal of the stalk, in the manner of a discharge of grape or cannister from a mortar. The highly active and poisonous drug, Elaterium, is obtained from the pulp surrounding the seeds.

That panacea for all domestic ailments, the Balsam Apple, also belongs to the cucurbits, and in olden times was as indispensable in a country farmhouse as the family Bible.

The watermelon, gourd or calabash, muskmelon or cantelope, the cucumber, supposed to be the same as mentioned in the book of Numbers, and now common in Egypt for the purpose of preparing a certain drink, the colocynth, pumpkin, and our edible squash, are all "squashes." The *cucurbita maxima*, or big pumpkin of our agricultural exhibitions exerts a wonderful power or lifting force while growing, and from a series of careful experiments made by a member of the Massachusetts Board of Agriculture, has been known to lift a weight of 5,000 pounds, or 2½ tons, and failed to perform more only by the giving way of the apparatus employed in the test.

One curious species, not yet referred to, is the Luffa, the fibrous network of the fruit of which, when deprived of its pulp and seeds, is called the Egyptian Bath Sponge, and is both sold and used as wash rags in the shops of London and America.

Mr. Martindale entertained his audience with minute descriptions of the various species, and we regret that this synopsis does so little justice to the subject of the lecture.

The New Jersey State Microscopical Society.—The Society met in Rutger's College, New Brunswick. The attendance was good. The meeting finished its action on the new Constitution and By-laws. A certified copy of the registered certificate of incorporation was given to the custody of the secretary. The election of officers is fixed for the annual meeting in April. The time for exhibition of slides was short. Mr. Warren showed diatoms from the pond deposit at Drakesville, which is used by the dynamite factory there. He also showed an original stained mount of tuft of chorion of human placenta. Mr. A. V. Baldwin showed an instructive specimen of multilocular cell structure in degenerated tissue in cancer of human liver. Dr. Williamson, a pretty mount of pollen and floral organs of the diminutive *Stellaria media*. Prof. Van Dycke, crystals of potash chlorate on black ground with polarizer; an attractive object. Dr. Lockwood exhibited pollen of *Cyclamen persicum*, the object being to show the prodigality of nature. While perhaps five pollen grains, properly applied, would be enough to fertilize the ovarium, here, seemingly, were millions wasted by a single flower. He advanced the opinion that this profuse supply of pollen stood related to the inverted position of the perianth, from the bottom of which was suspended the *andrœcium* or group of stamens. The inverted pistil projected from the centre of this group, but its stigma, or fertilizing point, was almost like a hair, thus it was a necessity to reduplicate manifold the opportunity to catch the fertilizing powder as it fell. Hence the lavish scale of the provision. He thought it would be interesting to know how much the insects had to do with the matter. The secretary also exhibited living specimens of Cypris, saying that he raised in his study several broods yearly. S. LOCKWOOD, Sec.

Buffalo Microscopical Club.—At the annual meeting of the Buffalo Microscopical Club, held at Grosvenor Library, February 10, 1880, the following officers were elected for the ensuing year: President, Prof. D. S. Kellicott; Secretary, Geo. E. Fell, C.E.; Advisory Board, Henry Mills, Esq., Dr. L. M. Kenyon, and Dr. Lucien Howe.

March 9.—The regular meeting of the Club was held at the Grosvenor Library. A good attendance was present. President D. S. Kellicott, read a short paper on "The Larval Habits of Goldenrod Boring Plume," one of the Micro-Lepidoptera. He stated that in August, in the vicinity of Buffalo, the small larvæ may be found common enough, boring into the twigs near the end, of different of the goldenrods; later in September the caterpillar abandons the withering and destroyed twigs, and bores into the stem a few inches above the ground; it descends into the roots where it passes the winter increasing in size until May, when it returns, enlarging its burrow, in which it pupates in June, the moth appearing the first week in July. Its life history is peculiar and it is believed to be the first and only one of the *Pterophoridæ* at present known to our fauna that has similar habits.

He also presented some remarks on the modern theory of the molecular constitution of matter, illustrating the same by drawings and models; the purpose was to prepare the way for discussions in the future of the fundamental laws of optics.

The subject of Prof. Kellicott's remarks was discussed by Dr. Lucien Howe, Dr. W. C. Barrett, Dr. H. R. Hopkins, Prof. H. Poole, Mr. J. W. Ward, and others.

Dr. Lucien Howe presented the subject of the undulations of light and their perceptions by the eye. Brief mention was made of the different theories, accounting for the phenomena of optics previous to the present century. The difficulties of this subject were first solved by Thomas Young, who satisfactorily explained the undulatory theory of light. He showed that what we call light is an impression produced upon the retina by the wavelike motion of the particles of matter. Subsequently the lengths of these waves were measured. It would take 36,918 waves of red light, or 64,631 waves of voilet light placed end to end to make an inch. From the speed of light, which has been measured, it is proved that at least four hundred and fifty-one millions of millions of these minute waves flow into the eye and dash against the retina in each second. Dr. Howe proceeded with a minute description of the microscopical anatomy of the eye, more particularly relating to the "layer of rods and canes." These were stated as being in reality the terminal filaments of the optic nerve. These are shaken or acted on by the waves of light, and it is especially these with which we see.

Dr. Howe's remarks were discussed by Drs. Hopkins and Barrett, Prof. Poole, and Messrs. Ward and Slocum.

Under the order of "Personal Work," Mr. Jas. W. Ward exhibited a piece of glass which had been over a picture on one of the walls of his residence. It was covered with a very peculiar and interesting species of fungus, and withstood the action of soap and water in attempting to remove it. He attributed the growth to the exhalations of the breath of persons who had been in the room, and since noticing this fungus on the glass had examined several of a similar nature in other rooms and found them alike. Mr. Ward's observations brought forth an interesting debate, relative to the observations of the different members of the Club on similar growths. Dr. Howe thought it similar to the fungus which attacks the body of the *Musca domestica* (house fly). These are contagious, and can be given by one fly to another. Dr. Barrett likened it to the fungi which permeates the walls of hospitals and other public buildings. President Kellicott, since the matter had been brought to his notice, had examined the windows of the Central School building, and the City and County Hall, and found fungi on them, although not to such an extent as on the glass Mr. Ward exhibited.

Prof. Poole had been making examinations of stains on a knife blade, and at a future meeting would detail the methods employed and the objects in view. Mr. Fell had been at work making examinations of handwriting with a view of ascertaining the value of the microscope in this class of investigation. The subject under consideration was of a legal nature, and he was not at liberty to go into details at present. He also mentioned that the publication of the "Proceedings of the American Society of Microscopists," which were then in his hands (being a member of Publication Committee), would probably embody a full report of the meetings held at Indianapolis and Buffalo. It appears that not any of the papers read at the former meeting would be inserted, owing to lack of means to publish them all. The accessible papers of the Buffalo meeting, to be published in full, are about as follows:

1. The address of President R. H. Ward.
2. On Certain Crustaceæ Parasitic on Fishes from the Great Lakes. By Prof. D. S. Kellicott.
3. Photography as an Aid to Microscopical Investigation. By Dr. Carl Seiler.
4. On the Systematic Examination of Objectives for the Microscope, with a Convenient Form for Recording Results. Dr. Geo. E. Blackham, F.R.M.S.
5. Observations on Lerneocera Cruciata. By Prof. D. S. Kellicott.
6. Some Observations Upon the Destructive Powers of Certain Insects. By C. M. Vorce, Esq.
7. The Preparation and Mounting of Double Stainings. By Mr. C. C. Merriman.

Several other papers not having been presented to the Secretary of the Society when the proceedings were sent on for approval to the different members of the Committee on Publication, will likely be added to the list.

Mr. Fell further stated that the next meeting of the American Society would be held at Detroit about the middle of August, and that the prospects for a successful meeting were very encouraging.

President Kellicott appointed Dr. W. C. Barrett to prepare a review of the current microscopical literature for next meeting. He also reported that Mr. Henry Mills would read the paper for the next meeting, Tuesday, April 13, the subject being "*Spongiadæ*, with special reference to *Spongilla* of Local Streams."

Several interesting microscopic accessories were exhibited, which we have not time to mention in this already somewhat lengthy report.

Geo. E. Fell, Secretary.

Griffith Club of Microscopy (Detroit).—Ninth regular meeting, held March 9, 1880. Mr. J. C. Holmes, assisted by D. J. McGuire, M. D., gave a demonstration of the circulation of blood, illustrated by young whitefish from the Detroit "hatchery." The young fish, less than a week old, and looking not unlike a pair of eyes propelled about by an exceedingly active tail, were found, under the microscope, to be possessed of all necessary "interior" arrangements. As they are nearly as transparent as glass, the action of the heart in receiving and propelling blood, and the stream of blood corpuscles down one side to the tail, and back on the other, could be distinctly seen and examined. The whitefish that are caught for this market are largely made to recognize their obligation to posterity, by passing through the "hatchery," where the *modus operandi*, as described by Mr. Holmes, is as follows: The eggs are stripped from the females by pressing their sides with the hands, and deposited in a large tin pan partly filled with cold water. Into this are placed two or three drops of milt, which is obtained by a similar process from one of the male fishes, and which contains the male principle of life—the microscopical spermatozoa. Each drop of the milt contains several thousands of these minute organisms, that would remain undeveloped but for the favorable conditions found in the female egg. These spermatozoa penetrate the eggs, and curling themselves up comfortably await the necessary five months to incubate. It is now the hatching season, and the unhatched eggs resemble a small pea, of a nearly transparent color, but with two distinct black dots on one side, which the microscope shows to be the eyes of the fish.

The Club now numbers 28 members, and a public soiree is a proposed measure of the near future.

San Francisco Microscopical Society.—The annual meeting of the San Francisco Microscopical Society was held at the Society's room, 120 Sutter Street, February 5, 1880. An unusual number of members was present, and the discussions evinced a determination to make the incoming year more interesting and beneficial to the Society and microscopy than any preceding one. The remarks and offers of assistance from members proved that the old time energy had not left the Society's members, and that its friends and workers are again coming to "the front."

Notwithstanding that the principal business was the election of officers, other discussions took precedence. Mr. Hyde sent specimens of some large barnacles taken from a vessel just arrived in port, after a long voyage from Ceylon, her planks so much covered with them that a powerful tug-boat had great difficulty in bringing her in through the Golden Gate. They were left for future examination. Mr. Hanks exhibited a specimen of Trichinæ Spiralis in the muscle of a boy who died with the disease (Trichinosis) near Salem, Oregon. It was given to Dr. S. M. Mouser, to be prepared for examination. W. W. Hanks also presented a donation of supposed diatomaceous earth, from D. W. Grant, Esq., found in Pacheco Pass, Cal., also left for future examination. C. W. Banks presented the Society a manuscript catalogue (bound in four volumes) of the books in the Society's library. At his own expense the donor employed a person for several months to complete this work. The catalogue not only contains a list of books, but of authors, and the subjects of which they treat. The thanks of the Society were expressed and tendered him for the generous contribution. The President's address is herewith annexed, to which the Society's friend's are referred. [This will be found in another column of this issue.—Ed. Am. J. Mic.] The Treasurer's report showed the finances to be in fair condition, yet desiring improvement for future operations.

The librarian reported that the library consisted of 500 volumes of selected scientific works, and was, without dispute, the best collection of its kind in the State. The cabinet contained about 4500 slides of mounted specimens of nearly every material and almost every subject known to science. The following persons were elected officers of the Society for the ensuing year: C. Mason Kinne, President; William Morris, Vice-President; Charles H. Denison, Recording Secretary (re-elected); Chas. W. Banks, Corresponding Secretary (re-elected); G. L. Murdock, Treasurer (re-elected).

Wellesley College Microscopical Society.—The regular meeting was held Monday evening, March 9, 1880. Miss Hayes, the newly elected President, in the chair. The members of the Freshman class of the college were present by invitation of the Society. The first paper, by Miss Beattie, on "Cell Walls," was finely illustrated by blackboard drawings, copied from her own work, as was also the next paper, by Miss Cook, on "Cell Contents." The remainder of the evening was occupied by Miss Whiting, who gave an exhibition upon the screen of crystallization. The substances used were: nitrate of silver, chlorides of ammonium, barium, potassium, sodium, calcium, sulphates of iron and copper, bichromate of potash, alum and camphor. Under the microscope were shown, with parabola illumination, several crystallizations; and illustration of the papers read, the following slides, prepared by Miss Painter: Crystalloids from potato tuber; Cystoliths from leaf of *Ficus elasticus*; crystals from onion; calla and leaf of cactus: starch granules from potato tuber, and milk sap of Euphorbia; stomata from leaves of lily and begonia, and stamens of Tradescantia.

M. VIRGINIA SMITH, Cor. Sec.

Minnesota Academy of Sciences, Minneapolis, Minn.—Microscopical Section.—The April meeting of the Academy was devoted to microscopy, under the general management of Mr. Kilgore, the chairman of the section. New microscopes were on exhibition, and furnished with accessories to show the special objects which are studied by the various owners, as follows:

Mr. N. W. Walker exhibited a Crouch instrument, with colored wood sections beautifully mounted.

Dr. A. E. Johnson had a Gundlach, with Fungi, as objects of examination, in which he has become a recognized able worker, through his reports published in the Bulletins of the Academy.

Prof. N. H. Winchell exhibited a Tolles' instrument, belonging to the State Geological Survey, readapted for lithological work, in which he is extensively engaged, and he displayed a number of thin sections of rock made by himself, and their action between Nicol prisms.

Mr. Kilgore exhibited two fine instruments by Beck, both binocular, and dwelt at some length on the particular excellencies of the binocular. Dr. P. L. Hatch also had a Beck microscope, with his animalculæ.

Dr. A. F. Elliott had a McAllister stand, with a variety of accessories, and showed thin sections of animal matter.

Dr. Gilbert had a fine Acme, admired for its simplicity and fine action, and Mr. J. R. Mendenhall had a very large and fully-equipped Tolles' instrument, probably the most costly on exhibition.

The Rochester Alga Club.—At an informal meeting of the Alga Club, of Rochester, N. Y., on Monday, March 1, it was determined that a census of the algæ must be taken this Spring and the ensuing Summer. It was decided that operations shall begin immediately, as the wayside pools and the brooks fed by warm springs are already beginning to teem with rarely beautiful forms of vegetable life ready for the bottle of the collector, and the careful preparation of the microscopist. The president, Dr. C. M. Booth, informed the club that he had ordered a number of works on the algæ in order to be fully prepared for the labor of the season, and expressed a desire for a considerable increase of membership, so that every pool and brooklet, every pond and lake in Monroe, Livingston, Orleans, Wayne and Ontario Counties may be closely watched. He did not expect a complete enumeration of the algæ beyond Monroe County this season, but confidently hoped for such beginnings in adjoining counties as would permit the Club to include those counties in its report, and insure their representation in the Club's exhibition. It is desirable to have a large number of members in Rochester and vicinity, as the work of naming and recording will be principally done in this city.

The Club decided to invite all who are willing to aid in the work of collecting, mounting, naming, and recording the algæ in the region named above, to send their names by postal card to C. M. Booth, No. 5 State Street, Power's Block. Those who furnish material or mounted algæ will be duly credited in the record. The locality, time of year, and name of collector will be preserved, with such remarks as the collector sees fit to make. Everyone who expresses a willingness to collect material will be considered a member of the Alga Club, and will be expected to make an exhibit at the Club's exhibition, which will be a feature of the annual soiree of the Rochester Microscopical Society.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Pleurosigmas and many other diatoms, marine algæ, and much miscellaneous material, in exchange for good mounted objects; correspondence invited. M. R. Booth, Longmeadow, Mass.

Well-mounted slides of human pathological specimens, viz.: Sarcoma, carcinoma, fibroma, and epithelioma, several varieties of each, also lung in pneumonia, kidney in Bright's disease, for other well-mounted pathological or histological slides; send for list. Henry Froehling, 59 N. Charles Street, Baltimore, Md.

In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

Will exchange selected named diatoms for well-mounted histological, pathological, and anatomical preparations; state what you have and terms of exchange; my preparations all good. W. W. Riner, Greene, Iowa.

To exchange for a microscope or accessories, a double barrelled breech-loading, laminated, steel barrel shot gun. F. O. Jacobs, Newark, O.

Wanted, in exchange for books on the microscope, Schimper's "Synopsis Muscorum Europæorum," and Berkeley's "Handbook of British Mosses." A. C. Stokes, Trenton, N. J.

Exquisite wild seeds, neatly mounted, in sets, by genera and species. Also pollens in balsam, arranged in same way. Rev. J. T. Brownell, Lyons, N. Y.

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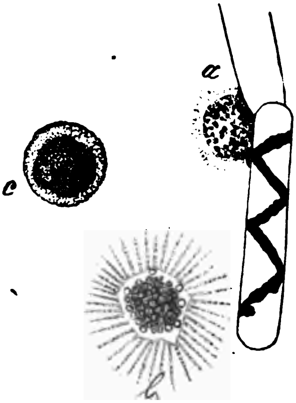
Notes on Vampyrella Lateritia.

IN the latter part of March, I gathered, from the bottom of a spring trickling down a hill-side, a quantity of ooze, which proved to be rich in rhizopods, the objects of my search. Among the many welcome captures in this successful venture, I wish to record the finding of two in particular: one on account of its comparative rarity, the other because of a certain interesting habit. The former is the *Hyalosphenia cuneata*, made particlarly attractive by the absolute transparency of its shell and sarcode, for which reason Prof. Leidy, in his magnificent work on the "Fresh-water Rhizopods of North America," says it would serve a useful purpose in the study of the life history of its kind, were it not "unfortunately exceedingly rare," he having found in four years but half a dozen specimens which, he states, were all from the same locality, thus giving the reader the idea that its distribution is remarkably circumscribed. I have, however, been lucky enough to find more than that number in a single gathering from a spring near this city. It is a charming object.

Of the second curious rhizopod referred to, I have frequently seen half a dozen on a single slide prepared from this same material. In color, it is reddish yellow, in general appearance much like the common sun animalcule, *Actinophrys sol*, but larger, more active in its movements, and with the power to change its form with greater facility. Dr. Leidy's description of *Vampyrella lateritia* is as follows: "Animal usually Actinophrys like, with a soft spheroidal body, capable of amœboid variations of form, composed of pale, colorless, granular protoplasm, with abundance of coloring matter, oil-like molecules, and vacuoles. Pseudopods as Actinophrys-like rays, Acineta-like rays? and digit-like, lobate, or wave-like expansions."

Near to the creature when first seen was a partially collapsed, transparent, hemispherical cyst attached to a filament of *Spirogyra*, as in the engraving *a*. It was suspected at the time that the rhizopod and the case were in some way connected, but it was not until several days later that the suspicions were confirmed. On filaments of *Spirogyra* collected from this particular spring, were great numbers of reddish brown, darkly spotted cysts. So numerous were they that many filaments bore three or four, and occasionally two were fastened on opposite sides of the same cell; indeed, I have seen eight in the field of a 1-5th inch objective, all adherent to the same species of alga. *Spyrogyra* is the favorite locality, but I have noticed a few on *Vaucheria*, and one or two, formed in captivity, upon cotton fibres. They seem to be attached to the plant by an enveloping transparent membrane, exhibiting minute points especially noticeable on the empty cases. I have never found them before this season, although I have gathered the alga even earlier in the year.



VAMPYRELLA LATERITIA.

From one of these cysts, partially occupied by a *Vampyrella*, with two active individuals in its immediate neighborhood, I saw that occupant emerge although I did not witness the beginning of the process. The concluding part was rapidly done, the soft bodied animal drawing itself through a small aperture with ease, and dragging out with it a long train of colorless protoplasm immediately absorbed into its body. It at once moved away, its rays projecting, minute bright drops of plasma running to and fro upon them, and a short blunt pseudopod occasionally thrust out and withdrawn almost as soon as seen. Its surroundings seemed unpropitious. In a few moments it became quiet, and took the form of which a representation is attempted in *b*, the six contractile vesicles in the outer hyaline portion repeatedly disappearing and returning. Shortly afterward, the rays were withdrawn, and it became a spherical mass, as shown at *c*, the coloring matter collecting at the centre, and the translucent periphery filling with minute particles which exhibited the Brownian movement. A moment later the ectosarc was suddenly ruptured, the entire contents were poured out, and the animal was broken up into oil drops, a woful ending of a short life.

Another individual appeared to be in a more robust condition. It made its way rapidly across the field of view, and it seemed as though some innate knowledge, some rational impulse, were guiding it, for without hesitation this little orange-colored mass of living jelly passed directly to a filament of *Spirogyra longata* to which it became attached, withdrawing a portion of its rays for the purpose, and conforming itself to the shape of the plant surface. There it had the appearance of resting, stopping the flow of protoplasmic drops along the rays just where each one happened to be. This was at nine o'clock. One minute later, I was surprised to see the first turn of the chlorophyll band within the cell suddenly fall down. In another minute the second turn followed; in three minutes, the entire cell contents were loose and slowly gliding toward the *Vampyrella* which was comfortably sucking them in. At five minutes past nine, the cell was empty, and the hungry animal moving to the next. Here the same operation was repeated. In its third excursion it placed itself across the partition between two cells, and proceeded to imbibe the contents of both at once. From one the chlorophyll bands were loosened and dragged out in a long strip, while in the other, they were broken down into a homogeneous green mass, and quietly sipped out, the *Vampyrella*, as Mr. Weller remarked on a certain memorable tea-drinking occasion, "a swellin' wisibly before my wery eyes."

It was not until seven cells were emptied, that its appetite was satisfied. I have since witnessed a repetition of this by another individual. The creature must have the power to secrete a fluid capable of dissolving the cellulose, and of acting upon the chlorophyll and protoplasm within the alga, besides its very evident ability to remove the latter without first dragging them out, or surrounding them amœba fashion. When the seventh cell had been cleaned out the *Vampyrella* transferred itself to a filament of another species of the same genus, where it again rested, but did not feed, with two short blunt pseudopods protruding as if clinging to the plant. I was then, unfortunately, compelled to leave it.

Two days later, however, the field contained a cyst presenting three very distinct lines, dividing it into as many parts. Almost as soon as seen, the *Vampyrellæ* began to escape, two making their exit at opposite sides simultaneously, the third, which the sac contained, following through one of the apertures already made. The process was a rapid one. A thick colorless pseudopod appeared first. Hardly did it touch the wall before the opening was made. The ray-like pseudopods were protruded before one-third of the animal had escaped. Many of the dark spots upon the cyst walls, probably of excrementitious matter, followed as free granules, others remaining behind.

Prof. Leidy, referring to the rays of *Vampyrella* says that they seem to be of two kinds, the ordinary variety similar to those of *Actinophrys*, and of pin-like rays which "consist of a short stem ending in a minute round head, and measure from 0·004 mm., to 0·0125 mm., in length," and "are especially remarkable for the quickness with which they are projected and withdrawn." He afterwards expresses doubt as to their existence, saying that the appearance of the pin-like rays as above indicated, may have been "illusory." In the specimens which I have seen, these pin-head rays have been conspicuous. Young individuals show them in great abundance and distinctness. As the animal grows older it seems to become more reluctant to project them, and just before it becomes quiescent, to enter upon the encysted stage, it is very seldom that one can be seen.

Although I have watched this creature enter its world, have followed it through all its life and into the tomb it fashions for itself, where one dies that three may live, and where it has been under frequent observation at short intervals, I can give no satisfactory account of the changes that take place between the sepulture and the triple resurrection, not only on account of the opacity of the object, an obstacle that might perhaps be surmounted, but because the proper magnifying power has not been at my disposal. To those who have high power objectives, *Vampyrella* would make an interesting study. A. C. S.

Trenton, N. J.

The Abbe-Zeiss High Angled Immersion Condenser.

VARIOUS forms of sub-stage illuminators have from time to time been presented for the consideration of the microscopic world, which but partially meeting the requirements of the working microscopist, the feeling has become somewhat firmly fixed that such an apparatus can, on the whole, offer no advantage over the common mirrors.

But the recent immense increase in the angular aperture of the homogeneous immersion objectives has compelled, not only the invention of an immersion fluid which will allow the transmission of the light rays without refraction, but also the use of some apparatus whose function shall be to impart to those light rays as great a degree of obliquity as the objective in use may be able to utilize.

The high 138° balsam-angled immersion condenser of Prof. Abbe, which is furnished by Carl Zeiss, seems to meet well all of the requirements of any case. It works perfectly with central light, with either high or low powers; and with its system of diaphragms, aided by its lateral rack movement, it furnishes light of an obliquity far in excess of the power of transmission of any objective now extant, and also one of the very best means of producing dark field illumination. It is, in short, so simple, so complete, and so convenient, that I believe that any person who has mastered the slight inconvenience attending the use of any new piece of apparatus, will find it so useful for every species of microscopical work that he will very rarely indeed desire its removal from the stand for any purpose.

The instrument, which Mr. Phin has very kindly caused to be engraved, consists, first, in a system of lenses—A, Fig. 1—of which the largest, which is nearly hemispherical, is 32 mm., and the smaller about 6 mm. in diameter.

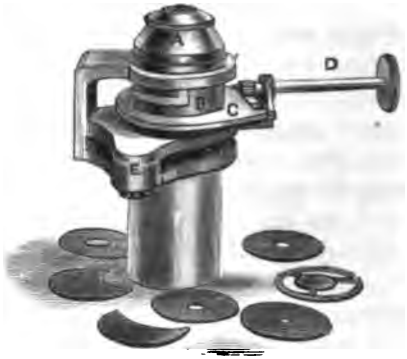


Fig. 1.

Immediately below this is a circular ring, B, somewhat larger than the lenses, in which are to be placed the diaphragms; those with central apertures of varying sizes for central light, those with central stops for dark field illumination, and those cut away laterally for extremest obliquity. This is also intended to carry the Nicol prism, when polarized light is desired, as the ring is arranged to be rotated in the optical axis by means of the handle, D, which also actuates the rack and pinion by which the plate, C, which carries the ring, B, with its diaphragms, etc., may be moved to the extent of 12 mm. on either side of the centre. By this rotation of the ring, the direction of the light pencils, can be infinitely varied and thus brought in any desired relation to the object under examination; so obviating the necessity for a concentric stage. The central position is accurately determined, without inspection, by a spring detent which falls into a notch in the plate when it is exactly centered.

For the convenient exchange of diaphragms, etc., the whole carrier, with B, C, D, can be turned in or out quite free from the stand—Fig. 2—by a plate turning on a lateral pin at E, without in any way affecting the lenses or any other part of the instrument.

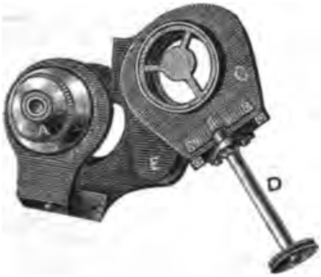


Fig. 2.

To use this condenser, a stand with sub-stage, provided with a rack and centering screws, is requisite, and to insure its exactly central position, a little piece of apparatus is furnished with the instrument.

The whole is fixed in the well of the sub-stage by the tube F.

When the condenser is in use, the upper lens is brought up to nearly touch the under side of the slide upon the stage. If the objective is an immersion one, the interval between the lens and slide should be filled with the immersion medium.

The plane mirror is always to be used, except when working with very low powers, in which case the concave mirror may be sometimes necessary to ensure a more complete illumination of the field. The mirror will, of course, be in the central position.

If a greater amount of light is desired than can be furnished by the plane mirror unaided, it can be readily obtained by placing a large bull's-eye condenser near the mirror at such a distance from the light that the image of the lamp is projected upon the mirror.

This instrument, from its convenience in working, the microscope being used in its ordinary slightly inclined position, its adaptability to use with either thick or thin stages, its simplicity of action, and the excellence of its performance, may, I think, be fairly entitled to the favorable consideration of working microscopists. L. M. Willis, M.D.

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Cell Division.

PROFESSOR STRASBURGER recommends* the hair on the filaments of *Tradescantia virginica*, or still better of *T. elata*, as peculiarly favorable for observing the phenomena of cell-division. The nucleus remains clearly visible during the whole course of its division, and all stages of its differentiation can be well seen without the application of any chemical reagent. If immersed in a 1 per cent. solution of cane-sugar in distilled water, the hairs retain their living condition for a considerable time, even as much as twelve hours.

The nucleus of cells still in a condition capable of division has a diameter of about 0·018 mm. The division takes place especially in the terminal cell of the hair, not frequently in the next, comparatively rarely in those lower down. The protoplasm of the cells contains only very fine granules, and there is therefore nothing to interfere with the observation.

The nucleus is sharply defined in its whole mass, and presents the appearance of a reticulate structure. While thus sharply differentiated on the outside, the nucleus has no skin or envelope which is distinctly differentiated towards the interior. It is only rarely that large granules are visible in the living nucleus resembling the nucleoli in form

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* 'SB. Med.-Naturwiss. Gesell. Jena,' 1879, p. 93.

When the nucleus is about to divide, it first of all begins to grow, the diameter in the direction of the longitudinal axis of the cell often increasing twofold in length. As soon as the nucleus has reached its full length, changes in its contents are apparent, and protoplasm begins to collect at both its poles. The nucleus now begins to become coarsely granular, and the granules to collect into lines which, of various lengths, permeate the nucleus more or less obliquely, and with more or less of an S-like curvature. The sharp external differentiation of the nucleus is then lost, and the starch-grains in its interior absorbed.

From three to four hours have now elapsed since the commencement of growth, and the following stages, till the complete formation of the daughter-nuclei, do not occupy much more than two hours. The granules in the lines first coalesce with one another, although the moniliform contour of the lines is still preserved; but they gradually become more and more obliterated. The object next becomes again sharper and clearer, and a larger or smaller number of threads penetrate the nucleus longitudinally, which again arrange themselves in S-like curvatures. These threads next become thicker and smaller in number, and exhibit a variety of patterns; but these changes proceed slowly, and are difficult to follow. At this stage the nucleus usually appears as if constricted in the middle.

The threads next begin to straighten themselves, this process advancing from the equatorial regions to the poles, where they somewhat approximate; and thus arises the typical form of the nucleus described by Strasburger as the "kerntonne" or "barrel."* It consists of a relatively small number of comparatively thick threads, or rather rods, which can be followed more or less continuously from one pole of the barrel to the other, both poles being characterized by an accumulation of colorless protoplasm.

Then follows the rupture of the barrel in its equator, first at the periphery, then in the interior. The rods are simply constricted in the middle, the outermost separating from one another somewhat in the form of a fan. From this time until the formation of the membrane of cellulose only about fifteen minutes elapses.

The two halves of the barrel separate from one another, but all the rods are not ruptured at precisely the same time, so that the separation is not at first very sharp. Between the separated halves of the rods there remains a hyaline substance, which, when fresh, is perfectly homogeneous, and remains so with 1 per cent. osmic acid; but treated with absolute alcohol or 1 per cent. chromic acid the most beautiful longitudinal striation is revealed. There can scarcely be any doubt that this substance was previously present between the rods, for the rods can be seen evidently to withdraw themselves from it. The author is induced to recur to his original view that in the division of a nucleus the rods owe their origin to this substance, which has been taken up into the nucleus, while, on the other hand, in free cell-formation they must, at least mostly, be differentiated from the protoplasm which surrounds the nucleus.

As soon as the colorless substance becomes visible between the halves of the barrel, the cell-plate becomes apparent in its equator, composed of a simple row of dark granules, the origin of which is difficult to trace. They soon coalesce into a continuous homogeneous pellicle, which is recognized as the new cellulose-wall. The granular protoplasm collected in the equator of the cell-threads is pressed aside, and the hyaline substance now lies distinctly in the form of a convex lens between the two nascent sister-nuclei, divided by the cellulose-wall clearly distinguishable as a black line. The striation of the hyaline substance is revealed by application of alcohol or 1 per cent. chromic acid.

These observations seem greatly to increase the importance to be attached to the part played by the nucleus in the division of vegetable cells.

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* See Journal Royal Microscopical Society, ii. (1879,) p. 910.

The development of the two new nuclei proceeds very rapidly in *Tradescantia.* Even while separating from one another the rods begin to coalesce, the process commencing at one extremity and advancing to the whole length, a longitudinal striation remaining visible for about half an hour. As soon as this disappears the young nuclei have a speckled appearance; but soon a definite separation takes place of the substance of the nucleus from the cell-sap, indicated by a distinct black punctation. In three-quarters of an hour at most from the time when the barrel begins to divide, the new nuclei have assumed their permanent character.

The young completely formed nuclei are at once sharply differentiated from the hyaline substance of the cell-threads, which is in the living condition altogether homogeneous. A few small vacuoles make their appearance between the young nuclei and this substance; while at the spots where the connection is still maintained the contour of the nucleus soon again disappears, and the substance of the cell-threads is clearly taken up into the nucleus. The young nucleus hence grows rapidly, and approaches on both sides the new division-wall. As soon as the absorption is completed, each of the two nuclei has again a sharp contour, and retires from the division-wall to the interior of the cell. The starch-grains, which resemble nucleoli, at the same time make their appearance in the nucleus.

The mature nucleus situated in the interior of the cell is suspended in but a small amount of protoplasm. Only at the apex of the terminal cell of the hairs of *Tradescantia* is found any considerable collection of protoplasm.

The reagents found to be best adapted for these observations are alcohol and 1 per cent. chromic acid; the latter causing least change in the object. The investigations were carried out in a moist chamber. On the covering-glass was placed a drop of 1 per cent. solution of sugar, which was spread out, and the entire freshly gathered stamen placed on it, care being taken that the hairs are immersed in the fluid. The covering-glass is then turned over, and placed with its edges on a papier-maché frame. In the suspended drop a number of hairs are sufficiently close to the covering-glass to allow of their study with Zeiss's immersion system I, a magnifying power of 550 with eye-piece 2.—*Jour. Royal Mic. Society.*

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Microscopy—Past and Present.

BY RUSTICUS, JR.

MY friend Pococurante never wearies of telling me his recollections of the "brave days of old"—of the days when Dr. Goring's object-glasses, and Chevalier's, and Amici's, and Dollond's, gladdened the hearts of dilettanti microscopists, by their marked advance on the old lenses. Here is one of his stories:—"I well remember how we amateurs used to vie with each other in displaying 'lozenges' on the scales of Podura Springtail when Mr. Carpenter (not yet F.R.S., C.B., etc.) first discovered them. How we did work at those 'lozenges'! They put me out of conceit with all my high powers, for Brooke had a lens made by Amici that beat mine out-and-out on them. We were both put sadly out of tune when Mr. Pond, the (then) Astronomer Royal, told us we ought *not* to have seen 'lozenges' at all, but 'hexagons'! I felt this bitterly. At first I thought of facing Pond by saying 'his deep sapphire lens' *could not* be so perfect an object-glass as Brooke's new Amici achromatic triple, and, therefore, our view as to the 'lozenges' was based on better instrumental means for making the observation—which I thought would be a 'non-plusser' for Pond. Brooke warned me, however, that if we were to provoke so great a 'gun' as Pond, he would probably retort upon us,—that we were a pair of hyperbolic dunces, the mass of whose duncedom could be appropriately expressed by multiplying the square of the length of our vertebral appendages by the square root of our mental density. With such a prospect *in* *terrorem*, we quietly dropped the 'lozenge' theory and called them 'hexagons.'"

Pococurante has long been known to pride himself on possessing excellent microscope lenses and appliances; to this end he has spared no time or expense. When I first knew him his *grande passion* was to display Podura magnified about fifteen thousand diameters; it was an image of a rather "fluffy" kind, but no body then showed anything better. At that date the "hexagons" were no longer in vogue; they had been "dropped" like the "lozenges," and the "notes of exclamation" had become the "definition of the period." As to Diatoms, Formosum, Balticum, and Angulatum had not been long in the field. It was "classical" to show the last in "triangles," which generally appear somewhat smoky and doubtful; but no doubt existed in my friend's mind that his 1-25th would "resolve anything resolvable." He was slow in admitting the "Amici" test—the Rhomboides—as a standard, and, until he mastered the "checks," used to decry it as "washed-out—not worth bothering with." When these tests began to be supplanted by the Grammatophora subtilissima and Acus, the game grew warmer; indeed, he regretfully confessed himself unable to cope with the difficulty of the Acus—he never could "touch" it satisfactorily with a dry lens. He was puzzled by the report that the Acus had been resolved and the "lines" counted to "140,000 to the inch," and he deferred his acceptance of the report *sine die*.

The advent of immersion lenses gave him a new start; the "triangles" on Angulatum gave way to "hexagons," and these in their turn became "dots," or "rows of hemispherical beads," according to the illumination used. Surirella gemma then became *the* test-object; from "checks" to "elongated hexagons" (Hartnack's erroneous definition) to "rows of beads" were easy transitions, aided by the sight of Woodward's photographs. The alleged "beads" on the Podura worried him; as, however, he could never get a sight of the "Aplanatic Searcher" (without which it was generally held to be impossible to "make them out"), he consigned that theory to the consideration of others. In those days his mind was much exercised how to obtain choice objects. I remember the following on that subject:—"We used to have great difficulty in finding good slides. A large part of my time was taken up in 'hunting' for them. Many and many a day have I passed with Bourgogne *pere* in Paris, going over his slides. When searching for tests, I was well rewarded if I found one good one after five or six hours' examination of a couple of hundred slides. 'Micro' was my great rival; he would 'hunt' for good slides with all the zeal of a 'grunter' after truffles. He was very ardent in effecting exchanges; I have heard him say he has given as many as ten, twenty—aye, forty slides, to obtain one that he coveted. There was one slide in his collection that had 'given me in the eye;' it was a colossal Angulatum: the cover-glass was so thick that his lenses couldn't 'get at' it. I don't care to confess to what baseness of cajolery I resorted to induce him to let me have that slide."

My friend likes to give microscopical *soirees* at his house. On these occasions he delights in exhibiting "popular objects," always, however, reserving one microscope for the "latest" test. When the ladies quiz him to show them a "wonderful" object, he will beg a hair from one of their fair tresses, stretch it on a plain strip of glass with a touch of wax at each end, gravely proceed to the microscope, and exhibit it magnified to the thickness of an elm-tree. The ladies express their joyous surprise, and the glow of gratified pride suffuses itself over his countenance as he indulges them with crumbs of scientific bewilderment. If the ladies throng round him with unusual glee, and he is equal to the occasion, he will go to one of his five thousand slide cabinets, and search, as if in absent mindedness, first one drawer, then another, for some precious slide. The carefully elaborate display of labels is sure to cause one or other to ask, "What's that? Oh, do, pray, tell me?" He will then have his moment's glory in explaining, amidst the fond hush of expectant curiosity, that "It is a section of the North Pole" (or some such rarity). There are, of course, loud demands, "Oh! do, do show me a bit of the North Pole? How very curious! Wherever did you get it? Did you bring it from the Himalayas, when you headed the Government Survey?" He playfully corrects the slight slips of the shy questioner, etc.

I admire the calm grace with which he gives his microscopical *soirees*. That section of the North Pole is always a rather disappointing object except in name, for the ladies see nothing much in it save that "it looks like a piece of green *moiree* silk." While they are discussing the various things it is like or unlike, he draws me aside and whispers, "My dear boy, whenever you want to 'show off' the microscope to a mixed assembly, show them what they can understand—something alive with plenty of light on it. They don't care for your Poduras, or your Grammatophoras, or your Acuses. Watch how I'll bring them round!" He fetches from the conservatory a little miniature fernery, containing some mouldy-looking pieces of wood, on which are clustered a number of dark-brown dots; removing the glass shade, and carefully looking with a hand-lens, he lifts up, with tenderest touch, one of the larger pieces of wood, and espies the object of his search—his giant bug. He picks it up with forceps, dexterously turns it over on its back, places it on a glass slip coated with a film of wax, holds it for a second or two over the lamp-flame, the wax softens and then immediately hardens, and holds the prisoner securely. What exclamations of delighted horror at the sight of this "monster," when magnified to about the size of a "hippopotamus!" What eager curiosity to see his ineffectual struggles to free himself from the waxen grip on his back! The thrilling wonder with which they listen to the explanations regarding the natural history of that "fellow!"—how his growth has been watched from day to day as he has been fed on "Liebig,"—how he has been tended with all the care that an illustrious naturalist has bestowed on *his* pet ants, etc., etc.—nothing can exceed the success of that bug.

How grandly my friend "shows off" his apparatus! How ruthlessly he pulls out all the queer-looking illuminating "dodges" from their tortuous nests in the apparatus boxes until the table swarms with them! And then to see his deftness in putting them all back again! That is indeed a sight. I confess I breathe more freely when the box lids are all safely shut down.

By the help of the most modern microscopical appliances, such as oil-immersion lenses, immersion illuminators, Ross's new swinging substage, etc., my friend keeps himself fairly *au courant* in microscopy. Nobert's famous lines have given him endless trouble. Until the immersion lenses became much perfected he had no satisfaction whatever with the higher bands of lines, and had, indeed, given them up as "not resolvable." Woodward's successive series of photographs of the lines have shown him that on the particular plate photographed the lines were certainly plainly ruled, and have been resolved; but he himself has not been so fortunate as to meet with so good a plate. He is the more convinced of the variableness in the plates, as he has every assurance his lenses are not at fault. Of all known tests, he regards Nobert's lines as the most severe. Webb's fine writing slides ("Bible plates") he regards as useful from the fact that one knows exactly what to look for; he regrets to hear they have been so generally neglected. He had hoped that Woodward's photographs of the fine writing published in the American journal, *The Lens*, would have largely popularised Webb's plates, but possibly the expense of them has been rather prohibitory. He has long possessed Möllers various test-plates and type-plates, which he regards as productions worthy of all praise.

It sometimes happens that Pococurante is pressed to give his opinions on the utility of microscopy. His most recent diatribes on the subject I may epitomise as follows:—"I look upon microscopy as an amusement. If anyone ridicules my hobby, I laugh at him. I am constantly being told that we ought all to work at what they choose to call 'practical microscopy,' and that my enthusiasm for the most perfect microscopical appliances is, after all, the cultivation of mere idleness. What they may mean by 'practical microscopy' I can't tell you precisely—probably 'various kinds of dings,' as Hans Breitmann would say. But, in high-power work, I suppose they would point to the development of 'life history' in minute forms of life. Well, now, suppose I were to devise means to enable me to perform some almost incredible vivisecting operations on the parasites of the sea-serpent; suppose I were to note down all the details of my operations with *quasi*-scientific unction, patching in some odd bits of fiddle-faddle conjecture on the origin of the parasites, and as to their possible influence on the propagation of disease. What would be the *use* of it all? True, I might make it the subject of popular lectures, illustrated by the magic-lantern; and there would, doubtless, be persons who would suppose this to be seriously searching for the origin of life, with some vague ulterior purpose of discovering the origin of disease. A fig for the origin of life! A fig for the origin of disease! If I were to join in that sort of work seriously, it would be for the serious purpose of getting my name to the fore—perhaps, even to secure certain awful appendages to it! But that would not interest me. I want to be amused. We all want to be amused. It amuses me to believe myself the possessor of fine apparatus; it amuses me to show it to my friends, and I believe it amuses them sometimes. If I get a little return from them in the shape of petty gratification of my vanity, is that any less honorable than more publicly catering for it? I don't envy those who cannot be satisfied with a social gratification of their vanity—who *must* have public displays. To tell me that the one is mere selfish idleness, while the other is unselfish labor, done exclusively (or even mainly) for the public good, is, what 'Uncle Toby' used to call 'fudge,' and I don't believe in it. According to my capacity I contribute to my own amusement and that of my friends, by riding my microscopical hobby-horse amongst them. I cannot see that my Podura scales, my Diatoms, my sections of the North Pole, my Nobert's plates, or my giant bug, etc., are a whit less intrinsically interesting or amusing than striped-muscle, parasites of the Lamellibranchiata, or of the sea-serpent, generative organs of the Cephalopoda, or than Bacteria *au naturel* or boiled, with or without sauce in the shape of the magic-lantern and wire-drawn theories of the origin of life or disease. I regard the microscope as a means of amusement, as a means of passing many hours agreeably with my friends, and I heartily wish those who can do more with it from a truly scientific point of view, to do so without needless fuss."

Pococurante says that, so far as his knowledge goes, the interpretations of high-power definition are not so much based on what is actually seen in the microscope as upon what the observer chooses to see. In his opinion a willing eye is as essential an equipment to the acceptance of any high-power image as the object-glass itself; indeed, a willing eye is even more apt to be the cause of erroneous interpretations than is an imperfect lens; the aberrations in the latter can be submitted to almost mechanical tests and guarded against, the former not so.

As to the interpretations of Podura,—that bone of never-ending contention—whether "lozenges," "hexagons," or "notes of exclamation," whether "beaded" or not in the "interstices," my friend no longer cares to propound any theory, but leaves these and other vexed questions to be solved, resolved, proposed, withdrawn, refuted, etc., by others. He is aware that eager aspirants to fame have not scrupled to bring forth high-sounding theories on the Podura, by way of labelling themselves as "microscopists;" the art of the aspirant consisting in the skilful invention of uncommon phraseology as a disguise to mystify the reader, whilst, above all, guaranteeing himself from refutation by presenting his views in an intangible, because incomprehensible, form. Thus have "novelties" been thrust into public notice, not because of their possible truth or utility, but merely to be talked of connected with the names of the *exploiteurs.—English Mechanic.*

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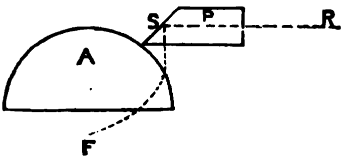
New Illuminator for Opaque Object.

MOST of our readers are, doubtless, familar with the method of illuminating opaque objects, devised by Prof. Hamilton L. Smith. In this, by means of a mirror placed above the back combination of the objective, the rays are reflected downwards upon the object, passing of course, through all the lenses of the object glass. A writer in the *English Mechanic*, describes a modification of this illuminator in which the rays pass only through the front lens of the objective, great loss of light being thus avoided. It is the invention of Mr. W. A. Rogers, of Harvard College Observatory, the well-known inventor of a machine for making fine rulings on glass, steel, speculum, metal, etc. The accompanying engraving will explain its construction:



ROGERS' OPAQUE ILLUMINATOR.

A, represents the front lens of the ¼ inch objective, (not to scale); P, is a small and narrow prism, made to slide into the brass mount of the front lens, to about the position shown. Parallel rays can be projected through the prism, in the direction of the ray R, and will be totally reflected at the internal surface S, whence they will fall upon the spherical surface of the lens, A, and be refracted nearly to its focus, F. The first illuminator has been constructed by Mr. Tolles, for Mr. Rogers, who says that for the examination of surfaces, such as diffraction rulings on steel, this method of illumination is superior to any that he has tried.

◆

Current Notes.

Casts of the Uriniferous Tubules.—Dr. Tyson read an instructive paper on this subject before the Philadelphia County Medical Society at its meeting January 14, 1880. The author makes the following general statements: 1. Hyaline casts are found in all forms of Bright's disease, as well as in temporary congestions of the kidney, active or passive. 2. Epithelial casts are found in acute, sub-acute, and chronic parenchymatous nephritis. In the latter two forms the cells are generally degenerated and fragmentary. 3. Blood casts are found in acute and parenchymatous nephritis, and when hemorrhages have occurred in the kidneys. 4. Pale granular casts are found in interstitial nephritis (congested kidney) and chronic parenchymatous nephritis. 5. Dark granular casts are found in parenchymatous nephritis, acute and chronic, and rarely in interstitial nephritis. 6. Waxy casts are found only in chronic Bright's disease, and attend either of the three principal forms. 7. Oil casts are found in subacute and chronic forms of Bright's disease, and may attend any of the three principal forms, but are most numerous in chronic parenchymatous nephritis (fatty kidney). 8. Free fatty cells and free oil drops are found in chronic parenchymatous nephritis. 9. The form of fatty cell known as the compound granular cell is found in acute and chronic parenchymatous nephritis.—*Phila. Med. Times.*

Mosquitos, Filariæ, Elephantiasis, and Malarial Fevers.—At a recent meeting of the Quekett Microscopical Club, the President, Dr. Cobbold, exhibited several filariæ from a mosquito forwarded to him from China. At the same time it was mentioned that he had also received fresh communications, not only from Dr. Manson, but also from Drs. Somerville, Bancroft, and J. da Silva Lima. It seems that Dr. Manson has made a new and very important discovery, which probably not only explains the periodicity of malarial fevers, but also many other hitherto unexplained physiological phenomena.

A New Cement.—Mr. A. P. Brown, of Camden, N. J., well known as a skilful microscopist, has prepared a new cement, which makes an elegant finish for microscopic slides. It is perfectly transparent; will not crack—and there is no danger of it running in and spoiling the specimen. If it becomes too thick to flow freely, add a few drops of benzole.

THE AMERICAN
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AND
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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the American Journal of Microscopy. This certainly demonstrates the value of the journal as an advertising medium."

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WE have now supplied the missing numbers of Vol. IV., of the American Journal of Microscopy, and can supply volumes bound uniformly, with those previously issued, for $1.50 each.

Since the beginning of 1879, we have electrotyped the pages of the Journal, so that back numbers can always be supplied. Vols. I, II, and III were not electrotyped, and consequently some of the numbers of these volumes cannot be replaced.

Omitted Credit.

BY a printer's error we omitted to credit the article on "Moina," in our last issue, to the *American Naturalist.*

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Correction.

IN the letter of Dr. Willis, in our last issue, (page 98), quoted in the communication of C. S., the numerical aperture of Tolles' 1-10th, is given as 1·125. This is a typographical error. The number should be 1·1125.

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Dr. Pelletan's Journal.

WE are in receipt of another number of Dr. Pelletan's *Journal de Micrographie.* As usual, it is filled with interesting and valuable matter, and we are glad to see the announcement that hereafter the journal will be issued regularly and promptly, as it is now upon an assured basis of success. The fact is, we presume, that Dr. Pelletan's readers did not appreciate his journal until they were deprived of it for a short time. They then found out what a good thing they came near losing.

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American Society of Microscopists.

THE next meeting of this society is definitely fixed for the 17th of August and following days. This meeting of the society will, undoubtedly, draw together all the representative microscopists of the country. Few more important scientific meetings have been held in this country than the last meeting of this society at Buffalo, and the meeting at Detroit promises to be equally interesting and important.

We hope every microscopist who can do so, will attend, and endeavor to insure the success of the meeting. We shall publish a full report of the proceedings as soon as possible after the meeting. A very complete report of the Buffalo meeting was published by us in our volume for 1879, and the address of the president, Dr. R. H. Ward, together with a number of the most important papers, were given in full.

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Micromillimetre, Micrometre or Sixth-Metre.

THE editor of the *Journal of the Royal Microscopical Society*, while accepting our objections to the use of the word "micromillimetre," seems to think that some term is needed, and suggests the word "micrometre." Such a word would, in this country at least, be open to the fatal objection that it would always be spelt *micrometer*, and would be confounded with the instrument of that name. It is true, that the pronunciation of the two words is different, but that would not remedy the difficulty. Besides, the contraction for "micrometre," would be mm., the same as that for millimetre. The proper way is to fall into line with the British Association Committee, and adopt the nomenclature suggested by Mr. Stoney, calling the thousandth of a millimetre or the millionth of a metre, a $\frac{1}{10^6}$ or sixth-metre—the prefix *sixth*, here indicating the negative exponent of 10, by which the metre is to be multiplied.

It is of the greatest importance that in this matter no blunder shall be committed which shall give rise to possible future mistakes. The path of every student is sufficiently beset by doubts and difficulties, without our throwing fresh obstacles in the way by introducing indefinite terms, or terms having a double meaning.

The Oldest Monthly Microscopical Journal.

THE AMERICAN JOURNAL OF MICROSCOPY is the oldest monthly journal devoted to microscopy that is published in the world, and with a single exception, (the *Quarterly Microscopical Journal* of London), it is the oldest microscopical journal in the world. We little thought when we issued the first number of this journal in 1875, that we would so soon be able to write these words.

Several attempts have been made in this country, to publish a journal devoted to microscopy, but none have survived more than a fraction of the time (short as it is), that this journal has been published.

At present, the prospect is that the AMERICAN JOURNAL OF MICROSCOPY will have a long lease of life. There never was a period in its history, with perhaps the exception of the first year; when new subscriptions poured in so rapidly, and at no period did we receive so many kind words of encouragement. As our readers and friends know, we make very few promises, and we shall not now change our custom in this respect. But our "past" is not a "dead" one, and we have no hesitation in pointing to past volumes, or to the preceding numbers of this year as an earnest of what our subscribers may expect.

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A Medical Postal Microscopical Society.

THE American Postal Microscopical Club, is well known to our readers as one of the most important societies now in existence in this country in connection with microscopical studies. It is obvious, however, that an organization which has been found so useful in general microscopy, could not fail to prove of even greater value to medical men, and in England a Medical Postal Microscopical Society has already been formed, as we gather from the folllowing letter which we clip from a recent issue of the *London Lancet:*

"Thanks to your insertion of letters on the subject, the effort made by the Postal Microscopical Society to establish a separate histo-pathological section has been most successful, and a number of boxes have been placed in circulation. Most of the slides have been of a very high order; some sent by a professional mounter, and others, the work of amateurs (medical men), are triumphs of section-cutting, injecting, staining, etc., and, being accompanied by accounts of the cases from which they were taken, are thus made exceedingly instructive. It is a great pity that slides illustrating rare forms of disease, or original investigations into the causes of morbid action, should be seen by the comparatively small number of medical men who attend the meetings of societies, and it will be a great boon to the profession generally if those who have such slides to exhibit would place them at the disposal of this society, that they may be seen by any of us who are interested in microscopy. The boxes have been gradually improved, so that it is almost impossible for properly-mounted slides to be injured in transit. The annual subscription is very small—namely, 5s.

We feel certain that a similar society would not only find support in this country, but would prove of immense value to our medical men. We hereby tender the services of this journal and of ourselves, to aid in establishing such a society here. Suggestions are in order, and those who desire to join may send us their names. No money is required at present, nor will any pecuniary obligation be incurred. After a sufficient number of names have been sent us, we will, at our own expense, print a list of them, which will be sent to each subscriber, and then the members can elect their own officers, adopt their own rules, etc. The whole business will be done by mail, and unless some unforeseen difficulty arises, it cannot fail to prove a success. Address all letters on this subject to John Phin, 14 Dey street, New York, and do not mix any other business up with this, as it is desirable that these letters be filed separately.

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Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

◆

F. J. Wenham, C. E.

IN the address of the President of the Royal Microscopical Society occurs the following tribute to this well-known microscopist:

"By resignation, the society loses a zealous and able coadjutor, for few have been more active during the past thirty years than Mr. F. J. Wenham, C.E., who was elected in 1850. Every year since, I think, he has contributed to our 'Transactions' one or more memoirs, besides notes and other communications. Not a few of these are characterized by great originality, and contain evidence of most careful and thoughtful inquiry. I trust I may be permitted to indulge the hope that Mr. Wenham may add yet more to the vast amount of useful work he has already done, and for which every one interested in the advance of microscopical inquiry already feels deeply indebted to him."

The debt which microscopists, all over the world, owe to Mr. Wenham, is not always fully appreciated. He very justly and generously awards the credit of the invention of the binocular microscope to our own Prof. Riddel, but to Wenham we owe that form of the instrument, which has made it accessible to the million. The pathway of microscopical progress during the past thirty years is marked all along its course with valuable inventions by Mr. Wenham. It is true that he may have made some mistakes; what of it? As Liebig said, "show me a man that makes no mistakes, and I will show you a man that does nothing."

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Reports of Microscopical Societies.

THE AMERICAN JOURNAL OF MICROSCOPY, has, from the first made a special feature of the Transactions of Societies, and to-day it is the only journal that publishes anything like the complete transactions of the different societies throughout the country, so far as reported.

It is our purpose to make this a still more important feature in the future, and to this end, we ask the aid of the officers of the different societies. The importance of such reports, *to the societies themselves*, is not always fully appreciated. These reports place all the societies in communication with each other; they stimulate the members to effort, suggest ideas for new lines of work, and foster the general *esprit de corps*.

We will be glad to receive from the secretaries or other officers, detailed reports of the transactions of their societies. In making up such reports, all matters of mere business detail, of interest only to the society itself, should be omitted. A report of microscopical work, however common, is always of value. We are all interested in knowing what the societies are doing.

Our Book Table.

The Microscope and Microscopical Technology: A Textbook for Physicians and Students. By Heinrich Frey, Professor of Medicine in the Univerity of Zurich. Translated and Edited by George R. Cutter, M.D. Illustrated by 388 Engravings on Wood. Second Edition. New York. William Wood & Co.

This work represents the German instruments and methods of working, just as Beale represents the English. Prof. Frey, like Beale, is an earnest worker, and one of the best manipulators; what he tells us is founded on actual experience, and the student may rely implicitly upon the directions given. Whenever Frey tells us anything that he has not himself put to the test, he mentions the latter fact, and the student is thus put upon his guard. It would be well if all writers on the microscope were equally careful. The book is divided into two parts, the first, containing the theory of the microscope and directions for selecting and using it; the second part forms a brief treatise on histology, the special feature of which is the directions for preparing and mounting the different tissues, etc. This second part is exceeding valuable to all medical students.

As regards the first part, we must confess to a feeling of disappointment. Excellent as it is, it is behind the times, no account being given of any of the new forms of the microscope or of the recent improvements in the optical part of the instrument. Thus, although the title page bears the date "1880," not a word is said either by author or editor, in regard to the peculiarities of the new objectives of Tolles, Spencer, Zeiss, Powell & Lealand, and others. We are merely told that Tolles and Zeiss have brought out objectives made on new formulæ, but nothing is said in regard to their peculiarities and advantages. Such omissions might be pardoned in a primer, but are scarcely permissible in a textbook. Besides this, old forms of the microscope, made by firms now extinct, are figured in the body of the work, not as historical examples, but as illustrations of the microscope of to-day!

The translation is disfigured by a very large number of unusual and in some cases incomprehensible expressions. Can the translator give us any other instance of the use of the expression "truly diabolical illumination" found on page 85, or tell us what it means?[*]

So, too, the word "spectral," for spectroscopic, and several other peculiarities of this kind, do not enhance the value of the book to beginners.

In the selection of objectives, Frey notes two attributes—defining and resolving power. The latter is also called "penetrating" power, and no intimation is given by the translator that the latter term has been applied by English-speaking microscopists to an entirely different property.

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[*] A friend at our elbow suggests that it may mean a *devilish glare*, as this is the most "diabolical" form of illumination that he knows of. Joking apart, however, the probable meaning of the term is *central* illumination—the word being derived from the Greek *dia* and *bole*. In this sense, however, the expression is unusual and misleading.

We note these defects and blemishes, because they have been carried down from the first American edition, although they have all been pointed out before. Frey's book is one of the most valuable that is now accessible to the student, and deserves better treatment.

The work before us is intended particularly for medical students, and for them it is probably the best book now in print. For the student of natural history, it is far inferior to Carpenter, and for the medical practitioner, it has not the practical value of Beale's works, but for the special purpose for which it seems to be intended, it is unequalled. It may therefore be interesting to note Frey's opinion concerning a few points about which there has been a great deal of discussion.

As regards Angular Aperture: He follows Mohl, who says that, on defining power, depends the distinct recognition of the outlines and forms of bodies: on resolving power depends the appreciation of their finer structure. Further on he says that objectives of high angles are of the greatest value when penetrating (resolving) power is required; but the defining power is usually relatively greater with a combination having a smaller angle of aperture. (Page 56 and 57).

This is, undoubtedly, correct, and is clearly and well stated. As price is the one great governing agent in this matter, we would put it thus: If your means are unlimited get high angles and the most perfect possible correction; if you have but a small sum to spend for an objective, get one of more moderate angle, but with corrections as perfect as you can afford.

In regard to cover correction, Frey perpetuates a very common error. He says; "With Hartnack's arrangement after each correction of the objective, the focus is naturally to be adjusted; this is not the case, however, with those of the English opticians, in which the position of the lowermost lens remains unaltered during the correction." (Page 58.) The device here attributed to the "English opticians" was invented by Mr. Tolles, but its effect is not what Frey claims for it. With each change of the cover correction, the magnifying power and the working distance of the objective varies. We possess some of Mr. Tolles best work, and speak not only from theory, but from actual observation. As regards magnifying power, Frey says: "According to my experience, we arrive at the limits by using a combination which magnifies with a weak eye-piece 1000-fold." Page 62.

As Dr. Frey is in the habit of using Hartnack's objectives, we are led to the conclusion that he places the limit of usefulness of high power in objectives at the 1-25th or 1-30th of an inch, (No. 13 or 14 of Hartnack). In this connection we may note that in this edition, as in the previous one, the statement is repeated (page 64). that the lines on the *P. angulatum*, can be seen with a magnifying power of 80 to 100 times. If Prof. Frey can see these lines with such an amplification, his eyesight must be extraordinarily acute. We have seen the lines on the angulatum with a one-inch objective, but the eyepiece was very high, and the amplification far beyond 80 or 100. We have never met a person who on actual trial could say that he could distinguish the lines on the *P. angulatum* with a lower magnifying power than 250 diameters.

Primer of the Clinical Microscope: By Ephraim Cutter, M.D., Member of the Philosophical Society of Great Britain, etc., etc. Boston: Chas. Stodder.

This is a pamphlet of 24 pages, intended to accompany a new and simple form of microscope, devised (we presume) by Dr. Cutter, and manufactured by the Boston Optical works. The idea of furnishing a special set of instructions for a particular microscope is a capital one, as the beginner is thus enabled to get exactly the information that he needs, and is not confused with a great deal of matter which at first is unnecessary. It is to be regretted, however, that the execution of the work cannot be commended as highly as the originating idea. There is an attempt at system which, while painfully defective, renders the book too technical. Thus, for example, an attempt is made to classify objectives somewhat in the same way that a botanist classifies plants, but, from the fact that the entire classification has for a central point the clinical microscope and its appendages, the result is, to say the least, somewhat singular. To the question, "What Classes Objectives?" we get the answer: "Varies with different makers; with Mr. Robert B. Tolles, (1) angular aperture, (2) complexity of structure, (3) definition and resolving power."

Now this may do for a maker's classification, but it seems to us that it will hardly serve as a guide to beginners; and when we are told, in reply to the question, 'How should you Rate this Objective?" that it is "American, Tolles, 3-system, 3d class, dry, not-adjustable; working distance 1-50th of an inch," we feel very much as we might suppose a student would feel when working over a system of zoology in which animals were classified into men, horses, carnivora, mules and quadrupeds. It is of no use to tell us that the objective is American if it is by Mr. Tolles, and no use to tell us that it is not adjustable if it is 3rd class, for third-class objectives have been defined as not adjustable. We are told what the working distance is—a thing which will vary with every length of tube which is used, but not what the approximate equivalent focal distance is.

We point out these defects in this case from a conviction that faults of a similar kind are common to almost all inexperienced writers, and tend to detract greatly from the usefulness of the work.

With many of the definitions we cannot agree. Some are positively wrong, as where we are told that the working distance "means the distance of the objective in focus from the object cover." The working distance of the objective is the distance of the front lens from the object. If we adopt the definition given by Dr. Cutter, then an objective of high power, whose special feature is its great working distance, might have no working distance at all if the cover were extravagantly thick. "Working distance" is an important characteristic of every objective, and it will never do to make it dependant upon the accident of a thick or thin cover. If we do so then it will be impossible to follow Dr. Cutter's own plan in "rating" objectives. If "working distance" depends upon thickness of cover, how can any objective be said to have a working distance of 1-50th of an inch, as he states in a passage just quoted? When we are told that an immersion objective is one of which the face is wet with water, etc., but half the conditions are stated. Not only is the face of the objective wet with liquid, but the liquid connects the face with the cover of the object.

We have never known any intelligent optician who defined a 2-inch eye-piece as one in which the length of the combination is 2 inches. A 2-inch eye-piece is one whose magnifying power is the same as that of a simple lens of two inches focus. Numerous other slips might be pointed out if our space would permit. It is greatly to be regretted that the publisher, Mr. Stodder, did not revise the manuscript. We feel certain that in that case the faults we have pointed out would have been eliminated.

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Microscopical Society of Camden, N. J.—Regular meeting April 1. Dr. Thomas M. Lloyd, of State Insane Asylum, Morris Plains, was elected a corresponding member and applications from four other persons for membership were received. The Annual Complimentary Soiree of the Society will be held in Association Hall, Third and Market, on April 15th, invitations to participate having been sent to the Biological Section of the Philadelphia Academy of Natural Sciences, the West Chester Microscopical and Philosophical Societies, Lancaster Microscopical Society, and the opticians and Scientists of Philadelphia. Letters of acceptance were read from many, and suitable arrangements ordered to be made for their reception and the entertainment of the visitors from a distance. The Society having adopted the plan of giving annual receptions, it is sought to make each one superior to the last in every respect, and it is expected that at least 100 instruments will this year display untold wonders to the guests of the Society.

As usual, the exhibits at the meeting were handsome and varied, particularly the slides of crystalized metals, gold, silver, chromium, etc., exhibited by A. P. Brown and H. S. Fortiner, which have recently been received from A. H. Chester, of Hamilton College, New York, by whom they are prepared. The preparations by our Society are of such a high order that constant demands for exchanges result in a great variety of objects being added to our collections from all parts of the United States. We rejoice in the prosperity of the institution, and hope the liberality of the management may increase the interest already awakened in scientific pursuits in our city.

A Soiree was held April 15, at Association Hall. This exhibition exceeded anything of a similar character ever given in Camden. The large room was set with tables, upon which there were a multitude of lamps, and appropriately distributed among them were the microscopes of the members and their guests, the visiting societies. So far as we could ascertain there were over one hundred microscopes on exhibition. Many of them of the costliest kind and latest improvement, the total value of which, with their accessory apparatus, could not have been less than twenty thousand dollars. At eight o'clock the visitors began to come in, and soon the room was filled with an assemblage of the best citizens, bent upon enjoying the revelations and surprises to be seen under the instruments. Over a thousand persons were present during the evening, and all were delighted and astonished at the display. At nine o'clock the Secretary, Mr. J. L. De La Cour, made an address of welcome and thanks to the visiting societies for their assistance and the honor of their presence on the occasion. At the close of which the President, Mr. A. P. Brown, in a few well chosen remarks, presented to the Secretary, on behalf of the members of the Camden Society, an elegant gold badge, a wreath of oak leaves, upon which rests a minature binocular microscope, as a mark of the appreciation of his associates for his indefatigable labors and zealous efforts for the prosperity and efficiency of the Society since its organization. The recipient, though taken by surprise, gracefully accepted the compliment offered him, and in suitable remarks returned his thanks, at the same time asserting that his services had merited no such distinction above his fellows.

Among the distinguished scientists present were Prof. Samuel Lockwood, Secretary of the N. J. State Microscopical Society; Dr. R. S. Kenderdine and Dr. J. Gibbons Hunt, of Philadelphia; and Prof. J. T. Rothrock, of West Chester, and others.

The West Chester Microscopical Society was also present, exhibited eighteen microscopes, mainly Zentmayer's, and made a fine display.

The Camden Microscopical Society of course made a fine display, both in number of instruments (twenty-five) and objects, chiefly of their own preparation. A list of these has been furnished to us, but want of space precludes its insertion.

The splendid cases of slides on exhibition, as the work of A. P. Brown, Prof. C. H. Kain, and H. S. Fortiner, were much admired, and showed evidence of great proficiency in the preparation and mounting of objects.

Mr. J. S. Cheyney, of Philadelphia, not being able to attend, had sent a donation of three dozen slides to the cabinet of the Society, which are also very perfect, and at the next regular meeting will be formally presented.

The astonishing progress of the Society is due mainly to the intelligence and zeal of its members, added to efficient management on the part of its officers. The Second Annual Soiree was a gratifying success, and the citizens of Camden will long have cause to remember the delights of the evening.

Microscopical Section—Academy of Natural Sciences, Philadelphia.—In a lecture on "Histological Studies," delivered before this Society on Monday evening, March 5th, 1880, Dr. Carl Seiler spoke, first, of the leading tissues of the body, as classifiable under the following heads: Epithelial, Connective, Contractile or Muscular, and Nerve Tissues.

The epithelial he divided into epithelium and endothelium; the former lining surfaces connected with the atmosphere, as the mucous membranes, glands, etc., and the latter lining closed cavities, as the blood vessels, serous membranes, etc.

The serous tissues are the *binding* membranes of the body, such as bone, cartilage and fibrous tissues.

Muscular tissue is divided into striped or voluntary, and unstriped or involuntary; the heart being an exception to the rule, its fibres being striated, and, of course, its action involuntary, except to a certain extent in some people who can partially control their heart's action.

Nerve tissue is divided into ganglionic, or generator of nerve force, and fibrile, or conductor of nerve force.

In addition to the above, the blood may be considered as a fifth class of tissue, and is uniform in its characteristics.

These various tissues are formed of cells, and are best studied in the fœtus.

In fœtal structures, or in the white blood corpuscle, we find the cells as globular masses, filled with granules in an active state of motion. Heitzmann and Klein claim that each of these granules is inclosed in a mesh of fibres within the cell, but Dr. Seiler has never seen this, and does not think it has been demonstrated. The granules gradually collect in one part of the cell, forming the nucleus, and a portion of these again condense still further, forming the nucleolus. The globule or cell now narrows, and throws out one or more fibres or tails; if these fibrils are at opposite ends, it forms the bipolar or spindle cell; if they are numerous, it forms the stellate or connective tissue cell. In fibrous tissue the cell retains its spindle shape.

Each special class of cell reproduces only itself, even if transplanted among other classes of tissue.

The existence of a cell wall is disputed.

In further development, the nucleoli, nuclei, and cell itself, divide into twos, fours, eights, etc., though sometimes a little irregularly, into threes, fives, etc. In this division the cells occupy more space, and press upon each other, giving them various shapes, according to the direction of the pressure.

The ganglionic cell is stellate, and shows the nucleolus, which the areolar tissue cell usually does not.

Rochester Microscopical Society.—The April meeting of the society was held at the Free Academy on the evening of Monday, the 12th, the president, Dr. S. A. Lattimore, presiding. The paper of the evening was read by Dr. Blackham, of Dunkirk, on "Penetration in Objectives."* He took the field in favor of wide angled objectives without perceptible penetration. He said: Penetration is the capacity of seeing at the same time objects in different planes and not exactly in focus. The eye has this power. One well known microscopist has said that if he had an objective as imperfect as the eye, he would send it back for correction. But penetration is less an evil in the eye than in an objective. With the eye the object is at a distance from the lens, and the image that is formed quite near, so that the images of objects lying in different planes of unequal distances from the lens may be formed practically together. In the microscope the conditions are reversed, the object being near the lens and the image at a distance, so that penetration in the lens must produce two images, which can be seen at the same time only by being confused, or melted together, at the loss of definition. In the eye the spherical aberration is corrected partly by the natural diaphragm the iris, partly by the uniform increase of density and refracting power from the periphery to the centre of the lens, and partly by the rapidity with which the eye will change its adjustment from objects at one distance to those of another. The penetration of the eye is really much less than is generally supposed, as will be shown by attempting to read at the same time two lines of print at slightly unequal distances from the eye. As the means of correction are less, penetration is a greater fault in an objective than in the eye. In the objective the effect is to blend the view of the upper plane with that of the lower and produce an apearance which has no correspondence in reality. What is needed in an objective is definition, or the power of making clear and distinct the details of structure. Work has been done with a wide angled 1-8 objective without penetration which a narrow angled 1-50 had failed to accomplish.

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* Dr. Blackham's paper will appear in full in this journal, as soon as the necessary engravings can be prepared.

In answer to a question by Rev. Myron Adams, Dr. Blackham stated that the lower the power the more penetration was allowable; that a 3-inch objective might have three times as much as a 1-inch, but that in high powers any perceptible penetration was in his opinion a defect.

Dr. Ryder followed in a few remarks, favoring wide angled objectives without penetration. He stated that as he understood it, the function of the varying density of the crystalline lens was to produce a higher degree of refractive power than would be produced by a lens of uniform density equal to that of the densest portion as it is, and that he was yet in doubt as to its effect in correcting spherical aberration. Dr. Blackham cited John W. Draper and others as authority for his position.

Dr. Forbes spoke briefly upon the difference between view lenses and portrait lenses for photography.

Mr. Fisher asked if there was a gain in wide angled objectives when a diaphragm was used in the tube of the instrument.

Dr. Blackham answered that as this referred only to binocular instruments, which he considered an absurdity in microscopy, he did not consider it in his discussion.

The president announced that Dr. J. T. Brownell, of Lyons, would probably read a paper at the May meeting. The society decided to hold a soiree in June similar to the one given last year. In response to an invitaton from the chair, Professor Kellicott, of the Buffalo Normal School and Mr. Fell, president of the Buffalo Microscopical Society, addressed the meeting, followed by Mr. Smith, a visiting member from Buffalo.

The following gentlemen were elected members of the society; Messrs. C. D. Kiehel, J. L. Angle, J. W. Goss, W. H. Osgood and Dr. W. C. Monroe.

The following objects were then exhibited: By Robert Bunker—Elytron of *cupes capalata;* scales of *planosa belada;* elytron of *chlonius sericeus*. By Adelbert Cronise—Aphis from dandelion; pollen of *abutilon;* elytron of *cyphus vanhageni*. By C. H. Clark—Artificial production of crystaline formation of snow.

Wellesley College Microscopical Society.—The regular meeting was held Monday evening, April 26, the president, Miss Hayes, in the chair, and several guests present. After the reading of the secretary's report, the Society passed a vote of thanks to Dr. C. E. West, of Brooklyn, for the loan of some fine slides. Miss Kitchell read a paper on "Rock Sections," giving the method of preparing them, the different kinds which come into the market, the advantages of microscopical investigation of rocks, the varieties of inclusions, and illustrating by blackboard drawings, liquid and other cavities. Sections of simple minerals and of crystallized rocks which showed the various peculiarities of structure, with the polarizer gave a brilliant effect upon the screen. Under the microscopes were exhibited the slides loaned by Dr. West, consisting of several of Dr. Thiersch's injected tissues, one of Dr. Watt's slides of gold crystallized by galvanic action, and crystals of silver and tin. A collection of slides of Lepidoptera prepared by Misses Waterman and Whitney were very beautiful. Miss Cummings exhibited a Protococcus reproducing itself by division, and several specimens of fresh water algæ.

M. Virginia Smith, Cor. Sec.

Microscopical Society of Liverpool.—The Fourth Meeting of the Twelfth Session of this society was held at the Royal Institution on Friday evening, April 2nd, 1880, Dr. Hicks, President, in the chair. The Hon. Secretary announced some valuable donations of books and slides. Mr. Phillip Holland, F.C.S., Southport, was elected a member of the society, and Mr. A. C. Cole, of London, an honorary member. Mr. I. C. Thompson, (Hon. Secretary), exhibited a very simple but effective form of aquatic trough, adapted for infusoria and other minute living objects, the ends being of any desired depth, of thin pieces of glass, and cemented upon an ordinary 3 x 1 slip, the cover resting upon these ends and kept in position by capillary attraction. He also called the attention of microscopists to a new and excellently illustrated work, entitled "The Biological Atlas," edited by Messrs McAlpine, of Edinburgh, which comprised a course of Biological study from the very lowest to the higher forms of animal and vegetable organisms.

Mr. Butterworth, of Oldham, read a paper entitled "A short History of the Discovery of the Fossil Plants of the Lancashire and Yorkshire Coal Fields," illustrated by sections and photographs by the aid of the limelight.

Mr. Butterworth stated that he had studied the richest localities in the Oldham and Halifax districts for upwards of twenty years, and exhibited numbers of coal sections preparad from specimens thus obtained. In some of them the stomata and other parts of plant structure were clearly visible under the higher powers of the microscope. A discussion followed, in which the Rev. H. H. Higgins, Mr. Morton, Dr. Symes, etc., took part. A hearty vote of thanks was accorded to the lecturer. The meeting concluded with the usual microscopical conversazione.

Griffith Club of Microscopy (Detroit).—This Club held a soiree on the evening of April 8th. The attendance was very large, and the meeting was a success every way. Microscopes, little and large, monocular and binocular, American, imported, of many patterns, occupied tables about the room, each exhibitor keeping watch and ward over the instruments under his immediate charge, and answering questions propounded. The objects exhibited were well selected for such an entertainment. There were not many requiring an extensive knowledge of technicalities, but all were interesting, and many very beautiful. The exhibits of adulterations in food attracted much attention, as did the specimens of sour buckwheat batter, enlivened by the presence of eels, and other objects of a similar character. President E. W. Wetmore, Secretary W. H. Brearley, and Treasurer R. N. Reynolds, of the Club, were all about the room, explaining and generally superintending matters. Each exhibitor was thoroughly familiar with his own display, and this of course enhanced the pleasure of all concerned. As a whole there never has been anything of the kind to equal it in the city, and probably not in this portion of the country, So well pleased are the members of the club with their success on this occasion, that it is quite probable a similar soiree will be held at some time in the near future, probably in June, under the same auspices.

There were 35 exhibitors in attendance, having 60 microscopes. More than 100 objects were exhibited. A detailed description of each would fill a moderate sized volume. It does not need to be said, however, that those present on this occasion had a glimpse of the things that exist in a world which to the majority of people is a sealed book.

At the Regular Meeting, April 27, the fascination of microscopical study was well illustrated by the demonstrations of Prof. Chas. H. Stowell, of Michigan University. Demonstration number one was upon epithelial cells, which he produced from the side and roof of his mouth with a "poetical" movement of the tongue, and deposited upon a glass slide, to all appearance, a drop of saliva. Skimming the air bubbles from the top with a pin, and removing the surplus saliva with a piece of blotting paper, he added a drop of staining fluid to better define the cells, and placing it under a microscope exhibited a multitude of thin, transparent scales, each about one five-hundredth of an inch in diameter, and containing a nucleus in the center. This he asserted was the form in which a large part of all bodies wasted, being thrown off through perspiration constantly. Demonstration number two was of glandular epithelial cells, from the scrapings of the liver of an ox, much smaller, but similar in some respects to those previously shown. Demonstration number three was of cells from the mucous membrane of the roof of a frog's mouth, which exhibited the extraordinary action of the cilia. These cells were fringed with hair-like protuberances, styled cilia, that moved with great activity and regularity, and seemed endowed with separate organic life and intelligence. The professor asserted that these cells were very common in the human body, noticeably in the bronchial tubes, where the cilia, moving always in one direction, were active in throwing off foreign substances injurious to health. Demonstration number four was of the circulation of blood in the feet of several frogs, rendered insensible by an injection of woorara.

One of the most noticeable features of the evening was the exhibition and use of 20 Ann Arbor frogs, which the professor brought with him as scientific curiosities, stating that they were a distinct variety peculiar to Ann Arbor, and of great rarity, possessing a most curious and interesting resemblance to the human body in one or two respects. Apologizing to the ladies present for so doing, the professor gathered the 30 gentlemen present at one side of the room and exhibited the distinguishing characteristics to them. Hereafter the Club will hold weekly meetings on Tuesday evenings, in the museum of the Female Seminary, 84 Fort Street, west. Dr. O. W. Owen will give a demonstration on the adulterations in articles of food, May 11.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. Exchanges only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Pleurosigmas and many other diatoms, marine algæ, and much miscellaneous material, in exchange for good mounted objects; correspondence invited. M. R. Booth, Longmeadow, Mass.

Well-mounted slides of human pathological specimens, viz.: Sarcoma, carcinoma, fibroma, and epithelioma, several varieties of each, also lung in pneumonia, kidney in Bright's disease, for other well-mounted pathological or histological slides; send for list. Henry Froehling, 59 N. Charles Street, Baltimore, Md.

In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

Will exchange selected named diatoms for well-mounted histological, pathological, and anatomical preparations; state what you have and terms of exchange; my preparations all good. W. W. Riner, Greene, Iowa.

Wanted, in exchange for books on the microscope, Schimper's "Synopsis Muscorum Europæorum," and Berkeley's "Handbook of British Mosses." A. C. Stokes, Trenton, N. J.

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Fresh-water Sponges.

SPONGE, is the familiar name of the family of the Spongiadæ or Poriferæ. The family is divided into three genera, which are named respectively from the substance which makes up the skeleton. They are called keratose or horny, siliceous and calcareous. All are aquatic and most of them marine. Only a comparatively few species, and these all siliceous, are known to grow in fresh water. These are called Spongilladæ, and the discussion of them forms the subject of this paper. The sponges offered for sale in our stores are simply the horny fibrous skeletons of the first genus, and are the only portion of all the Spongiadæ that have any commercial value. These may be found to some extent in most parts of the world, increasing in size and number as we approach the tropics. They are found in depths varying from tide-water to many fathoms below The skeletons of siliceous sponges consist of a net-work of siliceous spicula, which, like the horny frame-work of the keratose, is for the purpose of sustaining and holding together the various parts of the organism, which would otherwise be too weak and fragile to perform the functions of a living being. The calcareous sponges are the smallest, and perhaps the most insignificant of the three divisions, and are considered much the simplest in their structure. They are found in small white patches on stones and stems of sea weeds, mostly in salt water ponds and bays along the sea shore. The spicula of these are composed of carbonate of lime. Their shape is not symetrical like the siliceous spicula, but they are irregularly spined masses resembling somewhat the spicula of Gorgonia.

Soon after I commenced the examination of Niagara water with the microscope, I found certain little fusiform sharp-pointed bodies slightly curved and perfectly transparent. Sometimes they were in groups of from three to eight. Sometimes they were spined, and knotted with small wart-like excresences; at other times they were plain, and smooth as a polished needle. These I found to be the spicula of the Spongilladæ, and their presence in the water was evidence that the sponge existed somewhere in the river, and probably in many parts of the lake, although none were found till quite late in the fall of last year. Siliceous spicula are found also in many varieties of marine sponge, even where the main skeleton is keratode. They vary much in size, shape and character. Some are needle-shaped; some are bent at the ends; others radiate in three directions; others are quadriradiate; others multiradiate even up to ten rays. Some are bicurvate-anchorate, and present an appearance somewhat resembling the anchor-shaped spiculum from the skin of the well known Synapta. The office they perform in the growth of the sponge, as well as their origin, has been, and still is, a subject of great interest to the student, and great diversity of ideas have been advanced with regard to them. Some authors have described them as being crystalline and of an angular figure, and have, therefore, considered them analagous to the raphides in plants. Some have said they might originate from a transformations of cells in one stage of the sponge life; but this is denied by others. They appear to be the result of a process of secretion similar to what we know to be going on in many animals and plants. Undoubtedly the siliceous framework of the diatom is the result of the same process. Spicula have in the keratose, as well as in the siliceous, certain definite positions to occupy and certain offices to fill in the economy of the organism. Some are peculiar to the crust, and may be felt protruding through the upper surface; others are peculiar to the sarcode; others to the margins of the large canals and to the fibrous network of the skeleton. A very interesting variety of small spicula belonging almost, if not entirely, to certain large seed-like bodies, improperly called gemmules, are worthy of our closest attention, and we shall speak of them further in the proper place. The spicula, although sufficiently siliceous to withstand the action of strong acid, are not composed entirely of silica. They do not polarize, being in this respect like the Diatomaceæ.

Sponges of any kind are difficult to keep alive; especially those parts of them which throw light on their life history. When broken from their resting places and stored in still water, the gelatinous mass which envelops the whole sponge becomes very offensive by decomposition, and leaves only the skeleton and a few other parts in an organized form.

Let us now proceed to examine more particularly the parts of a specimen of Spongilla as they present themselves under the microscope. For this purpose, we place a section under a low power. The first thing that we notice is a rather beautifully netted frame work of siliceous spicula woven together, being lapped near the ends at an oblique angle and held in place by some means which is not very well understood, and about which there has been some discussion.

Besides this framework, we find a mass of gelatinous matter having something of a fleshy appearance. It is in reality the sponge flesh. It fills up the meshes of the network, and appears to be sufficient to hold the spicula in place. In some species of Halichondria there is said to be a sort of horny substance mixed in with sponge flesh in some way, so that the spicula are held together by that. I have one or two mounted specimens of a sponge taken from an oyster shell, the spicula of which are held by some substance that does not yield readily to the action of acid. The gelatinous substance above described constitutes the living body of the sponge. Twenty-five or thirty years ago, Dujardin, for the want of a better word, gave it the name of sarcode, and all subsequent observers have concurred. This sarcode fills the meshes of the net, as we have said, whether the framework is made up of horn, or silica, or lime.

When we say that the meshes are filled up, it must not be understood that the mass is solid. There are numerous channels and chambers for both the ingress and egress of currents of water which are required to convey food and oxygen through the organism. Some of these channels are required to carry off all excreta and rejected matter. The inlets and outlets of these channels are called the pores of the sponge, and form one of its most distinct characteristics, so that the name Poriferæ has been given to the whole family. There are small pores in great abundance for the admission of streams of water and food, and a fewer number of large holes, called oscula, which are the outlets for all that enters by the pores except the food assimilated.

The passage ways inside the mass are lined with myriads of ciliate or flagellate monads, which are constantly in motion striking the water, it is thought, always in the same direction with their flagella. These are the motile power of the constant stream of water in and out of the channels. The chambers in the body of the sponge or spongilla are called ampullæ or ampullaceous sacs. These are lined with the same living motors as those occupying the channels. The sacs are nearly round in figure, and are much constricted at the opening. The striking of the flagella is most likely uniform and simultaneous, like the action of the cilia by which Volvox is propelled. The Rev. Samuel Lockwood speaking of this remarkable and beautiful phenomenon says, "Now if we could peep into the privacy of that chamber, with its walls of living atoms, without making any disturbance, we should find every cell lashing its cilium with great vigor, and all in such harmony of accord that it would seem like,

'Beating time, time, time,
In a sort of Runic rhyme.'"

He says further, "The result of this downward beating of the cilia from a myriad of cells is the impulsion of passing water through the ramifactions leading to the oscula. Thus the running of the water is the sponge's ancient Runic rhyme." To see anything of this we need a living specimen, and the highest and best manipulation of the microscope. The ampullaceous sacs, the channels, and the cilia of the monad (motionless of course) may be seen *in situ* by taking sections of a fresh specimen which has been preserved in alcohol and imbedded in parafine.

In our examination of the specimen, we next meet with the so-called gemmules or seed-cases, which are large round or oblong bodies about .02 inch in diameter, lying mostly in the lower layers of the spongilla. They are said to be more common in autumn, though not strictly confined to that season. They are thought to contain a quantity of sponge particles that have become encysted and are set apart for the winter. These bodies have been called by many names by different writers, such as gemmules, seed cases, capsules, ova, winter-buds, and ovaria.* Lieberkuhn noticed four kinds of these ovaria, characterized respectively by their cases or shells. First, those with smooth cases. Second, those with stellate amphidiscs. Third, those with discs in which the discoid extremities are entire and not stellate. Fourth, those whose cases, instead of amphidiscs, have minute, usually slightly curved, siliceous spicula. S. Fluviatilis would be included in the second of these divisions, and in the last all S. Lacustris. Mr. Dawson of Montreal, in a paper on the Spongillæ of Canada, says he considers S. Fluviatilis and S. Lacustris as belonging to two distinct types. He further says, "It has been found, on extending the knowledge of the genus, that all new forms naturally fall into one of these. In the first series are included those spongillas in which the gemmule or reproductive capsule is built up of birotulate spicula placed side by side and arranged with their axes radially. In S. Lacustris the capsules are more leathery, but covered, when mature, with straight or curved spicula arranged at right angles to the radial lines." The Micrographic Dictionary speaks of these capsules as, "Exceedingly small bodies called seeds or gemmules, which are spheroidal and have an opening at one point." Now the term "exceedingly small" scarcely applies to these bodies. As a microscopist, studying the minute anatomy of an object, I would call them large bodies, and the query comes to my mind as to whether the writer of the article had not some idea in his mind of the true gemmule, which is really a small body. Carpenter, in his edition of 1856, in speaking of the true gemmule, makes use of this language, "With regard to the reproduction of sponges, multiplication by gemmation is effected by detachment of minute globular particles of sarcode from the interior of the canals, where they sprout forth, as little protuberances whose footstalks gradually become narrower and narrower, until they give way altogether. These gemmules, like the zoospores of algæ, possess cilia, and, issuing forth from the vents, transport themselves to distant localities, where they lay the foundation of new fabrics." He further says, "According to Huxley, a true sexual generation takes place, as might be anticipated, both ova and sperm-cells being imbedded in the substance of the sponge. The bodies distinguished as capsules, which are larger than the gemmules, and have their investment strengthened with siliceous spicula very regularly disposed, are, probably, the result of this operation." In Zoology, a gemmule is an embryo of a radiated animal at that stage when it resembles a ciliated monad, and therefore is not the large seedcase or ovarium which has been called by that name. The ovaries have an opening or foramen which may be seen with a low power. In one variety which we have found in the river, it is simply a round hole with edges well rounded off; in another it has a long tube terminating with five finger-like processes. From these openings, at the proper season, the contents of the case issue forth in the form of sponge cells, ova or monads. Mr. Fullager, of England, states in a recent number of *Science Gossip*, that he had in a vase, S. Fluviatilis, which grew long enough to perfect the ovaria and then died. At the return of the season, he was agreeably surprised to find the ovaria springing into life. One that had attached itself to a piece of weed, he succeeded in removing to near the surface of the water, so that he could examine its growth with a pocket lens. As it grew, he was interested in watching the incurrent and excurrent through the pores and oscula. He has seen small portions of the sarcode separated from the growing new sponge, and, in an amœboid fashion and form, move slowly away from it and settle down at a distance from the ovarium out of which, no doubt, they originally came, and has seen them growing into independent sponges with their oscula extended, from which the excurrent was seen to flow as from the larger sponges. He says, "I have observed some very small bodies of sarcode, somewhat irregular in form, and throwing out spines similar to Actinophrys sol."*

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* When we remember how little was known of the sponge till within a very few years, we must not be surprised at the irregularity of nomenclature in the many writers who have expressed themselves on the subject.

Two very neat illustrations accompany Mr. Fullager's paper. The small spicula of the ovaria, to which reference has been made, are birotulate. They resemble two toothed wheels joined by an axle. In the slides which I have prepared you will notice that the ovaria in some collapse when mounted. The upper side sinks down and becomes hollow. In these hollows, the foraminiferæ in some may be seen, and, surrounding most of the ovaria, may be seen the birotulates in great abundance. A quotation from Bowerbank, will direct your attention more closely to one or two points on which the specimens throw some light. In speaking of the birotulates, he says, "They are packed very closely together, their shafts being in lines radiating from the centre of the ovarium to the circumference; the distal rotulæ supporting the outer surface of the wall, while the proximal rotulæ support the inner one." He says further, "Carter, in his paper on fresh water sponges in the Island of Bombay, in describing the birotulate spicula, S. Meyeni and S. Plumosa, species with ovaries very similar to those of S. Fluviatilis, states that the spaces between the rotulæ are filled up with a white siliceous or amorphous matter, which keeps them in position." Bowerbank says he was indebted to the kindness and liberality of the author, Carter, for specimens of the species, and subjected them to the action of hot nitric acid, but has never succeeded in finding any intervening siliceous matter. "Nor have I," he says, "found any such cementing material in any other similarly constructed spongilla." The specimens before you plainly show what Carter refers to, except that the white amorphous matter is of a brownish color, and is, as it appears to me, a deposit of lime instead of silica, and is easily removed by the application of hot strong acid. I find it very difficult to determine the character of the wall of the ovaria. Having subjected a fragment of sponge containing some of them to the action of hot nitric acid for a short time, I applied sufficient force to the slide in mounting to crush the ovaria. As a result, I find that in some instances a portion of the case is broken off and slipped forward, so that a sectional view of the wall is presented with the birotulates *in situ*. In this sectional view, the proximal rotulæ appear not to include the inner surface of the wall; that is, they do not go through and sustain this surface. Yet if we focus down a little, using not less than a half inch objective, we find that the rotulæ are plainly visible in the concavity of the empty ova case.

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* I should not have mentioned this last item, but for the fact that I have a few of the ovaria in a bottle standing in a light warm window. On examining one of them a few days ago, I was surprised to find several bodies quite similar to the ova, and quite a number of the Actinophrys sol at every dip of the pipette.

I cannot account for this unless the acid has taken away a portion of the inner surface of the wall, and laid bare the rotulæ. In a different part of the same object, what might be taken to be another thin wall presents itself, and, at one time during my investigation, I supposed there really were two walls. Further observation showed that the membrane giving the above appearance is that which performs the office of placenta to the contents of the ovarium. In one or two ovaria on the slides prepared, these membranes have slipped out, carrying with them a few of the spicula.

I am not aware that there is now any doubt among naturalists as to the title of all the Spongiadæ to a place in the animal kingdom. The difficulty has been, and still is, where to place them in the scale of classification. From the time they were rescued from the vegetable kingdom till within a few years, they were included among the Protozoa, the very lowest forms of animal life. Latterly, some writers, including Hæckel and, I think, Huxley, and Hyatt, of the Boston Society of Natural History, have placed them among the metazoa, or egg-bearing animals; but, as they seem to have characteristics of both Protozoa and Metazoa, we conclude that their true taxonomic place cannot be assigned till intelligent and persevering observers shall have learned more of their modes of propagation and their true life history. We will glance at a few ideas advanced by some of those who have studied the subject under the most favorable circumstances, and learn what we can from their labors. W. Saville Kent, one of the greatest observers among the flagellate monads, says, "If, as Hæckel, and the advocates, in whole or in part, of his theory, assert, sponges are composed of separate multicellular membranes or tissues, they undoubtedly find their nearest allies among the Cœlentarata, including the Sea Anemones and Hydroid Zoophytes. If, on the other hand, as represented by Prof. Clark, they consist of aggregations of unicellular collar-bearing flagellate monads, their place is unquestionably adjacent to the more simple unicellular Protozoa, including the ordinary monads Rhizopoda and Infusoria." Kent says further, "Given, a single one of these sponge monads, such as we have described as lining these chambers and channels, and a perfect sponge body can in a little while be built up. By a mucus-like exudation from its surface, the basis of the syncytinum or sarcode is laid. By a repeated process of cleavage or fissi-gemmation, the original sponge monad quickly multiplies itself, though still more rapidly and effectually by the subsequent encystment and breaking up of the monad bodies into spores." Hyatt, regarding the sponge as an animal and an individual, not a colony, says, "It has an outer membrane, ectoderm, and an inner membrane, the endoderm, and a middle layer, the mezoderm, which builds the skeleton and forms the egg, and spermatozoa. The sponge is produced by a single egg, which grows without budding, by multiplication of cells of the outer parts, which may extend into branches; but these are not produced or formed from a bud any more than when the whole remains a round flattened mass." Barrois, as quoted by Hyatt says, "After the cells (of the ova) have acquired the peculiar collars and flagelli which are so characteristic of the young, the cells around the open pole are very much enlarged;" and the latter says, "When the proper period approaches, it selects some appropriate place, some hard surface, and attaches itself for life by spreading out close against its resting-place a little sucker-like disc surrounded by a circular cushion, which has formed at one end." They are, as Hyatt describes them, "minute yellowish opaque bodies." He says they come from the mezoderm, from which they have freed themselves by means of their flagelli. The Micrographic Dictionary says that the ova are formed by cells separating themselves from the sarcode, and becoming nucleated and nucleolated. The granule cells burst, and the spermatozoa are set free, and, coming in contact with the ova cells, impregnate them, and determine the development of ciliated germs. They escape from the ova-cells, swim freely, and finally attach themselves to something, and grow into Spongillæ. The endoderm, already spoken of, extends through all the chambers and channels in the sponge, and is the habitat, so to speak, of the myriads of workers which go to make up a complete organism, or, as Kent has it, the sponge community. Hyatt, in speaking further of these monads, and of their manner of taking in food, says, "They (the particles of food), are digested not in permanent stomachs, for these cells have none, but in little hollows or temporary stomachs, as they might be called, which are formed about each morsel. Refuse, or undigested particles are finally liberated from the same area, and carried through an opening opposite to that at which the food entered.[*]

Mr. Bowerbank paid great attention to the subject of the propagation of Spongiadæ and he says, "From the researches of the various authors who have written on the structure and development of these organisms, both fresh water and marine, it appears that there are three well established modes of propagation; First, by ova; Second, by gemmation; and, Third, by spontaneous division of the sarcode. The terms ova and gemmules," he says, "have been used so indiscriminately by authors that it seems advisable to define and limit their application in such a manner as to distinctly separate one form of reproduction body from the other. On careful review of the results of my own researches, and those of previous observers, it appears that the following may be considered as the varieties that exist in the mode of propagation of the Spongiadæ:

1st. By ova without an ovarium.

2nd. By ova generated within ovaria.

3rd. By gemmules secreted within the sponge.

4th. By gemmules produced externally.

5th. By spontaneous division of the sarcode."

The Spongillæ found in Niagara river by our President and myself, are of two kinds. One so much resembles that described by Dawson as S. Asperrima, that I have called the mounted specimens which I have prepared by that name, at least provisionally. I think the differences are no greater than might occur as errors in description. Dawson describes S. Asperrima: "Sp. nov. sponge sessile, encrusting, thin; surface slightly undulated. Oscula rather large, scattered. Skeleton spicula, fusiformi acerate, slightly arcuate; stout, densely spined with the exception of extreme apices; length 0·01 to 0·009. These are mixed with a few more slender. Spines minute, acute. Ovaria sub-globose; dia. nearly 0·02. Spicula birotulate, short; rotulæ equal in size; flat, very deeply divided, 0·0005 equal to, or greater than the length of the shaft; radii not acute; shaft with a distinct boss at each end." The length of shafts in our specimen appear to be nearly 0·0007. The bosses at the end of the axle of the birotulates of this specimen, partly owing to the high refractive character of the spicula, present appearances not readily interpreted. On looking from above through the bosses and shafts of the spicula, one can scarcely avoid the conclusion that the shafts are tubular, and that one is looking through them into the ovarium. To see this a portion must be found which has escaped the action of the acid.

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[*] As this action is so entirely characteristic of the Amœba, one of the lowest forms of Protozoa, we cannot regard the statement as an argument in favor of a very exalted place for the monad. The process of taking in food by this flagellate monad is beautifully described and illustrated in an article by W. Saville Kent, published in the *Scientific American Supplement*, No. 126.

The other specimen found by Prof. Kellicott, and presented to me by him, is, I think, an unnamed species, although Mr. Dawson, to whom I sent a very small fragment, thinks it may be S. Baileyi. A description of it will terminate this paper.

Sponge low, branching, green, growing on upper surface of stones in not very deep water. Skeleton spicula fusiformi-acerate; slightly arcuate, moderately stout, spined. Spines small, sparsely distributed; length 0·01 to ·012, apices naked. These are mixed with a great many fine delicate spicula densely spined to the end; length 0·009, scattered in groups on slide of mounted specimen. Cannot say what is their true place in the sponge. Ovaria globose; dia., 0·02. Foramen tubed, tube terminating with five finger-like processes somewhat resembling tentacles. Spicula birotulate; long, very delicate; length of axle, ·0015, one or more large spines on axle. Rotulæ slightly arcuate, equal in size. Length of tube to foramen 0·01. Length of tentacle shaped processes 1-50 to 1-80 inch.

Rusty Gold.[*]

RUSTY gold is a term applied to placer gold which escapes amalgamation in hydraulic and sluice washing. For many years it has been a common belief among miners that a large proportion of gold passes through the sluices, under-currents, grizzlies, tail-races, and other appliances, coming repeatedly in contact with quicksilver without being arrested by it, and finally escapes. By others this has been held to be a mistake, and what was believed to be gold covered with rust, was, in reality, something else. I must admit that I never had much faith in the theory of rusty gold, as I have repeatedly examined samples claimed to be in that state, which failed to show any abnormal condition. Most of the samples sent to me were from quartz, in all of which cases I found the gold to amalgamate without difficulty. Within a few months I have had my attention called to some placer gold, which has made me a convert to the opinion so often expressed by the miners. I have brought samples this evening for your inspection. They were furnished by Mr. Charles W. Banks, Corresponding Secretary of this Society. They are from a large deposit of Feather River tailings, at a locality below Oroville, in Butte county. The following is the result of a chemical and mechanical examination of this interesting material: Under the microscope the particles have a dark brown color, showing in some cases nearly white silica in irregular imbedded fragments, forming a compound cement, having, when magnified, the appearance of a conglomerate or breccia. Some of the samples were wholly coated, others only partially so. In somé cases the coating was perfectly opaque, hiding the gold from sight, while in others it was semi-transparent, through which the gold was plainly discernible. Placed in mercury those pieces wholly coated were not acted on; those only partially so became amalgamated to the extent to which the gold was unprotected. The coating was found to be brittle. When the pieces were turned on their edges and struck lightly with a small hammer the coating scaled off, leaving the gold bright and clean, after which it amalgamated without difficulty. On boiling some of the rusty gold in hydro-chloric acid the coating was decomposed, silica separating, the acid acquiring a golden yellow color, and giving a strong reaction for iron, the gold was left clean and bright. Six of the particles boiled in hydro-chloric acid and weighed before and after in milligrammes, gave the following result:

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[*] A paper read by Mr. H. G. Hanks before the San Francisco Microscopical Society Feb. 19, 1880.

	Before.	*After.*	*Loss.*	*Per Cent*
No. 1	126.5	125.0	1.5	1.18
No. 2	28.0	26.5	1.5	5.30
No. 3	40.0	35.8	4.2	10.50
No. 4	25.1	22.3	2.8	11.20
No. 5	18.3	16.8	1.5	8.30
No. 6	33 4	32.7	0.7	2.10

Average percentage of the coating by weight, 6.43.

Mr. George Atwood, son of Melville Atwood, of this society, read a very interesting paper on this subject in July of last year, before the Chemical Society of London. The specimen, or nugget, upon which his experiments were made, was much larger than those I have described—so much so, that the microscope was not required to study the ferruginous coating. This coated gold was obtained personally by Mr. Atwood from the State of Guayana, Venezuela, South America. From the fact that Mr. Atwood found finely divided gold disseminated through the coating, and attached to the surface of the larger nugget, he came to the conclusion that gold nuggets grow larger from external causes. The following are his own words:

"In conclusion, from the above experiments, made and recorded, on a gold nugget, covered with a glazed ferruginous earth, it would appear to me to prove that gold nuggets do gradually increase in size, owing to the accumulation of fresh particles of freshly precipitated gold."

I am not prepared to venture any theories at the present time, but desire to continue my investigations, with the hope that they may throw some light on this very interesting subject; and as the miners of the Pacific Coast are more directly interested than I am, I do not think it too much to ask them to send, to the Corresponding Secretary of the San Francisco Microscopical Society, small samples of gold for examination, with the promise that the results shall be made public, through the publications of the society.

Some New Slides From the Richmond, Virginia, Diatomaceous Earth.

THE large proportion of sand and foreign matters contained in this deposit, as ordinarily found, renders a tedious and troublesome process of cleaning necessary before anything like a fair showing can be obtained; and however careful one may be, certain forms are always lost or destroyed during its progress.

The severe drouth of 1879, caused many of the wells about Richmond, which drew their supply from water resting upon the Diatomaceous Stratum, to go dry.

The owner of one of these deepened his well through this Stratum to obtain a constant outflow from beneath it, and I watched the digging with much interest, as the location was at some considerable distance from any spot heretofore examined. Most of the earth brought up was below the average in richness, but a few samples were found richer by far than any hitherto seen, and almost purely Diatomaceous.

From these I have prepared a series of five slides which gives the fullest and most satisfactory exhibit of the deposit yet made.

No. 1 is the natural cleavage, not quite a millimetre in thickness, the growth of one season perhaps, mounted opaque, showing the Diatoms abundantly *in situ*, just as they fell on the old ocean floor ages ago. With binocular, this is specially beautiful, although it may be well seen with monocular and any low power up to 4-10ths.

No. 2 is the natural deposit, dissolved in water, and mounted in hard balsam, without treatment of any kind. The very small quantity of sand contained enables one to draw the cover down close enough to obtain fine views with the high powers. With these the great richness of this specimen is well brought out, and it is exceedingly interesting as giving a clearer idea of the composition of the deposit than any other preparation.

No. 3 is carefully washed without chemical treatment, shows the Diatoms free from most foreign matters, and also such forms as are usually destroyed by acids.

No. 4 is fully treated, most of the small forms and broken fragments removed. It shows a great variety of Synedra not usually seen on the Richmond slides from other localities, as well as all other forms usually met with, in fine condition.

No. 5 is a separate mounting of the smaller forms, suitable for ¼ inch or higher powers. It is particularly rich in the more uncommon species of the deposit, and has a great variety of them, on one small experimental slide for instance, I have counted nearly 60 different species, a list of which is given below.

1. Navicula Lyra.
2. Navicula Firma.
3. Navicula Peregrina.
4. Actinoptychus Splendens.
5. " Senarius.
6. Actinocyclus—8 rays.
7. Asteromphalus Brookeii.
8. Asterolampa Marylandica.
9. Coscinodiscus Oculis Iridis.
10. " Lineatus.
11. " Marginatus.
12. " Craspedodiscus.
13. Cestodiscus Ovalis.
14. Cymbella, Ehr.
15. Chaetoceros incurvata.
16. " Diploneis.
17. Cocconeis Scutellum.
18. Biddulphia Tuomeii.
19. Biddulphia Concinna—Bailey.
20. " Baileyii.
21. Dictyocha Aculiata.
22. " Fibula.
23. Doryphora Amphiceros—Raphoneis.
24. Grammatophora Marina.
25. Goniothecum Rogersii.
26. Dicladia Capreolus.
27. Herotheca Mammilaris.
28. Hemiaulus Polycistinorum.
29. Orthosira Marina.
30. Mastogonia Actinoptychus.
31. Pleurosigma Angulatum.
32. " Virginica.
33. Podosira Nummuloides ?
34. Pyxidicula Cruciata.
35. " Appendiculata.
36. Nitzschia Curvula ?
37. Sceptroneis Gemmata.
38. Stictodiscus Grevillii.
39. Systephania Corona.
40. " Diadema.
41. Rhizosolenia Americana.
42. Triceratium Undulatum.
43. " Striolatum ?
44. " Pileus ?
45. " Variabili ?
46. " Marylandica.
47. " Alternans ?
48. " Pileolus ?
49. Triblionella Hantzschiana.
50. Pinnularia Lata.
51. Synedra Lanceolata ?
52. Odontidium pinnulatum.

A number of other forms I was unable to classify, some of them very curious, and undescribed in any work to which I have access. C. L. Peticolas,

Richmond, Va.

"Sheep Rot."

FOR some time a great mortality has prevailed among sheep, and the destruction reported is something appalling. The malady is popularly known by a very old Saxon name; "rot," and is in reality due to the presence in the liver and hepatic canals of numbers of the Distoma hepaticum, a trematode entozoon, as well as the Distoma lanceolatum, also a member of the same order. These entozoa, from their resemblance to the fish called "flukes," have received the same name, and have a particular predilection for the biliary apparatus, whose function they more or less destroy, and thus lead to the slow death of the sheep or other animals they may infest. After wet seasons, animals which have been pastured on tainted land are certain to suffer, from their having ingested with the herbage the ova of the Distoma. Pastures are tainted by "fluke" infested sheep, which pass the mature worms or their ova with the fæces, and these lodge on or are washed into the ground. The worms, of course, die, and the ova within them are liberated; and these, together with the free ova, appear to have not only a strong vital resistance to meteorological alternations, but also the good fortune to find a ready and acceptable intermediary host in the Limnæus minutus, a little mud-snail common everywhere, and particularly on wet land. This snail becomes possessed of a number of ova in its interior, and during damp weather it crawls from its breeding place in the ground up the stalks of grass and herbage, and is swallowed by the sheep or other herbivorous animals when they are grazing. Received at first into the stomach, the ova undergo partial development, and then find their way into the biliary canals. If their number is considerable, when they have attained their full growth, they dilate and obstruct these canals, the walls of which become considerably thickened. During their development the secretion of bile becomes gradually diminished, and that fluid is viscid, like mucus, and altered in color; at the same time the parenchyma of the liver becomes atrophied from the compression the "flukes" exercise upon it, and it may even become disorganised. Hence results icterus, disturbance in nutrition, anæmia, dropsy, and a general cachectic condition.

Sheep are not the only victims which suffer from the Distoma, for during the present mortality hares, rabbits, deer and horses are said to have become infested, and died. The Distoma hepaticum has long been known to exist in the horse and ass, when they were allowed to pasture on unclean land during the wet seasons.

Salt appears to be an excellent and well-known prophylactic agent, and even a curative one when the disease has not made much progress. This beneficial action of sodium chloride has been known almost from time immemorial, and the freedom from "rot" of sheep which have been pastured on salt marshes has been also recognised for centuries.

The flesh of sheep which have been affected with this verminous disease cannot be said to be positively dangerous as food, though it must be greatly reduced in nutritive properties, as well as in quality. The human being may receive and harbor the Distoma, a fact worthy of remembrance. The present mortality is likely to render sheep scarce and expensive in this country for some time, and still further darken the prospects of our agriculturists.—*London Lancet.*

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Microscopy at the American Association.

DR. S. A. LATTIMORE, Chairman of the Sub-section of Microscopy of the American Association for the Advancement of Science, which is to meet at Boston, August 25th, desires us to announce that the local committee has made the most complete and ample arrangements for the accommodation of the Sub-section. The entire Physical and Biological Laboratories in the Institute of Technology will be placed at its service. In addition, two large rooms may be used which are fitted for projections of any kind, day or evening.

The most perfect facilities will be furnished for the display of microscopes and accessories, as well as for their safe keeping during the session, without trouble or care to the owners.

It is earnestly hoped that these efforts of the local committee may elicit a large attendance of the microscopists of the association, and induce many others to seek admission.

The Iris Diaphragm an Old Invention.

IT is generally supposed that the iris diaphragm, as applied to microscopes and telescopes, is a very recent invention, but the following passage, taken from an early volume of *Nicholson's Journal* (1804) shows that it is three-quarters of a century old.

"Every attentive observer must have taken notice, that light is of as much consequence to artificial vision as magnifying power. It may therefore afford matter of surprise, that the most variable of all adjustments of the eye, viz., that of aperture, should never be introduced into our artificial combinations. Distant woods, and other land objects, are invisible to a high magnifying power, for want of light, when the same objects may be distinctly seen with a lower. By means of an artificial iris, which an ingenious artist will find little difficulty in contriving, this disadvantage in telescopes might be obviated. Suppose a brass ring to surround the object end of the telescope, and upon this let eight or more triangular slips of brass be fixed so as to revolve on equidistant pins passing through each triangle near one of its corners. If the triangles be slidden in upon each other, it may readily be apprehended that they will close the aperture; and if they be all made to revolve or slide backwards alike, it is clear that their edge will leave an octagonal aperture greater or less, according to circumstances. The equable motion of all the triangles may be produced either by pinions and one toothed wheel, or by what is called snail-work."

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Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Mr. Stodder and Angular Aperture.

Ed. Am. Jour. Microscopy—Mr. Stodder, for years past, has been afflicted with an aperture craze, which has found vent in this journal, in a virulent personal attack upon myself, on account of some explanations made by me elsewhere. I will not wade through the controversy of the last ten years to seek for discrepancies. I leave Mr. Stodder to vex himself with this task—its ever recurring quibbles have become odious to every one else. I note one point only—as described in the *Quarterly Journal of Mic. Science*, No. 11, July, 1855. I obtained the full aperture of an object-glass, on an object immersed in Canada balsam, by cementing with this a nearly hemispherical lens exactly above a selected *diatom*, and brought over it a 1-5th objective (of which this lens then formed a fourth element). I say of the effect, that objects in the same slide in which the markings are scarcely to be discerned without the additional front, are sharply visible beneath it. This is the same as the formula since claimed by Mr. Tolles in his duplex front system, as shown by his illustrations, twice repeated.

Though not so received at the time, Mr. Stodder now denounces my practical experiment as a "wretched adaptation," remarking that I do not say that I obtained a greater angular aperture. I afterwards mounted the lens in a setting to slip over the front of the others. I still have the same object-glass. With balsam it might be considered as a "homogeneous" immersion lens, and used with brightly refractive oil, it brings out *Amphipleura* readily. I did not "say" what aperture I obtained, but in my diagram *delineated* the angle transmitted. By measurement the interior or balsam angle is 104°. I should have explained differently had I anticipated that twenty-five years after this my experiments were to call forth the bitter jealousies and sneering remarks of individuals attempting to claim my ideas for themselves and others. Thus, this time back, it was I that first obtained an angle of 104° in balsam or glass, and showed how it was to be accomplished; yet in the face of an arrangement made for the very purpose of securing a large angle, my commentators have been trying to persuade the world that I have held that under any circumstances an angle beyond 82°, in balsam, is an impossibility, although I then got 104° on the object within the slide. Mr. Stodder has some crotchet about rays coming out of it; and because no more than 82° can emerge below, he would instruct us that the angle of my object-glass itself must have been limited to 82°. The conditions of the angle in glass or balsam were the same then as now. As Mr. Tolles' agent, his word should be worth something, but Mr. Stodder must learn simple optics, before he can influence any one by his opinions this way.

In this same paper of 1855, I point out the theoretical advantage of enclosing the object in the centre of a minute sphere, in which rays both from the condenser and object-glass, pass directly to the object without refraction. This led to the idea described early in the following year of the now universally adopted immersion illuminators originated by myself, in several forms, including the "Woodward prism." Near twenty years afterwards Mr. Tolles propounds the same idea of the sphere. This question of the radial front and sphere may be considered as an inference of plagiarism against him, but notwithstanding the "ire" and "animus" imputed to me, I should have passed it by, had not Mr. Stodder's remarks induced me to notice it; he is not to be accepted as a judge; temperate argument from him is impossible, and I decline to discuss the question or again rake up the squabbles of the last ten years. His motive is apparent to all; this is to attribute to Mr. Tolles the ideas published and practically demonstrated by me a quarter of a century ago. This is all that Mr. Stodder can do; he has contributed no information whatever to the science of the question.

F. H. WENHAM.

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Pleurosigma Angulatum.

Ed. Am. Jour. Microscopy—While reading Dr. Wythe's article on "Improvement in Microscopic Eye-pieces," in the April number of this journal, I noticed this expression: "* * * the hexagons on *P. angulatum* are well seen with a one-fourth objective." Now let us see if this is correct.

I have as fine an objective as I ever saw; it is a homogeneous-immersion, but being provided with a good screw-collar, admits of sufficient over-correction to permit of its use as a glycerine or water immersion, or even as a dry lens. The angular aperture is large—turning the corner with a surplus of 18°. It *easily* resolves a balsamed *Amphipleura pellucida* by lamplight—and doesn't ask the aid of a condensing lens between the mirror and lamp either.

I also have as fine specimens of *Pleurosigma angulatum* as I ever saw—by different mounters too. Now, the queer fact relative to this is, that although I have examined and studied this diatom with a great many objectives—from 4 inch up—I have never seen a hexagon on it. Queer, isn't it?

My preliminary description of my cedar-oil immersion is simply intended to show the reliability of the glass. Although only a 1-6 (magnifying 57 diameters at ten inches from the front lens), it yields amplifications as high as *twenty thousand* diameters! I expect that some will doubt this assertion, but I can simply state it as a fact, and "back it up" by actual measurement. And when I furthermore state, that with this power of twenty thousand diameters the definition is sufficient to show the lines on the last three diatoms of my Möller's *balsam* platte, I expect the number of doubters will be very much increased. But this I have done and can repeat. Now, should not such a superb lens show us *something* of the true structure of so coarse a frustule as that of *P. angulatum?* I think it should.

When I fail to make out a structure satisfactorily with a certain 1-5 of 175°, I call in the aid of this 1-6. The 1-6 and my slide of Möller's *P. Angulatum* have had a fuss for some time past, and the result seems to be that the diatoms throw off their garb of hexagons and come out in their true apparel—*round dots.*

I said that I had never seen this diatom in hexagons. To some extent this statement is misleading. I have, I think, seen as much hexagonal structure as any other person, but I do not believe *anyone* ever saw a hexagon on this diatom! When a very cheap objective is used for the examination, it is almost impossible to pronounce them other than hexagons; but when a power of from three hundred to twenty thousand diameters is used—and with an aperture of "+180°"—it is hard to believe them hexagons, *unless* the lens is thrown very much out of adjustment for cover.

When several round spots are placed close together, and looked at from a distance, it is well known that they appear as hexagons. Now, if the interspaces be made larger, they are not so readily mistaken.

Applying this to the dots upon the *angulatum*, and knowing that the *coma* is less in a well-corrected than in a more inferior objective, it is readily seen *why* it is usually looked upon as consisting of hexagonal markings. The interspaces are filled in by the coma—which, of course, is equivalent to approximating the dots—and therefore we have the usual misinterpretation of structure.

Another, and probably more frequent cause of this misinterpretation, is the fact that this diatom is so commonly used with oblique light. An elevated dot (bead) *must* cast a shadow, and as a shadow will fill up the interspace—even with a first-class objective, it is readily seen that they are considered as marked by hexagons.

Then, again, we so frequently see a portion of the valve of *P. angulatum* figured in books that it is quite natural to accept them as they are figured, especially if we can not command as high a power as is indicated in the figure. NELLY A. ROMEO.

Coldwater, Mich., May, 1880.

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Growing Slides.

Ed. Am. Jour. Microscopy.—It often happens that when the microscopist wants a "growing cell" he wants it "on the spur of the moment," and nine times out of ten it is either just the thing he cannot get, or the single one within his reach is not adapted to his purpose. We are not all ingenious enough to invent the proper bit of apparatus; and to look through the books and magazines is not always convenient, or even possible, especially for those who have not access to large libraries or collections of scientific works. It has occurred to me that an article of some value to the readers of this journal might perhaps be prepared, so as to bring together in one place, for convenience of reference, a number and a variety of growing slides, if the necessary material could be collected. It is true that the dealers in microscopical supplies offer cells for sale, but as they cost almost their weight in gold they are not for many of us. If the idea should meet with your approval, and if you will ask your readers to send to my address descriptions, with drawings, if needed, of any growing slides they may have of their own invention, which they are willing to contribute to the good cause, or of any they may have met with in their reading, I will gladly piece the fragments together in the hope that the result may be of some use and value. Yours truly,

ALFRED C. STOKES, M. D.

TRENTON, N. J., May 25, 1880.

Preparing Slides.

Ed. Am. Jour. Microscopy—With this communication I send you a mounted slide, which is, I think, something new, the process of preparing it being so simple, and the beauty of the mounting being so much enhanced thereby, that I am impelled to give it to you for the benefit of those who, like myself, may like to do things in the best and most attractive manner.

Almost the first question asked by those seeing the slide is—How do you manage to grind your glass, leaving the spot occupied by the cover clear? The process is this: The slide is ground all over (upon one side only) until it presents an even, opaque surface. Upon applying the balsam in mounting, all that part under the cover is again rendered transparent, and in cleaning up, the balsam should be taken away as close as possible to the edge of the cover.

In grinding the glass I use a slab of zinc, with emery and water, and can prepare them, finishing the edges and all, at the rate of three dozen per hour, and I think the appearance of the work when done will amply repay for the time spent by those who may give the matter a trial.

Wm. C. Brittan.

135 Cass St., Detroit, May 12, 1880.

[The slide which accompanied the communication of Dr. Brittan is certainly very elegant and unique. Those to whom we have shown it have invariably supposed that the work was done by the sand-blast; none have hit upon the real method which, thanks to the kindness of Dr. Brittain, we are enabled to publish.]

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Correction.

Ed. Am. Jour. Microscopy—Will you do me the kindness to say in the next issue of the Journal, that a mistake has been made in accrediting me with the invention of the interior illuminator, described on page 115 of the May number. In a paper read before the American Association for the Advancement of Science, held at Saratoga, in August of last year, upon the adoption of this form of illumination to the microscopes of a meridian circle, I distinctly assigned the priority of invention to Mr. R. B. Tolles, of Boston. The mistake of ascribing the invention to me has, doubtless, arisen in some way through the efforts which I have made to call attention to this illuminator as possessing decided advantages over every other form in physical researches involving measurements of graduations on metal surfaces.

There have been three and perhaps five independent inventors of this particular form of illumination, but the priority of the publication, and I believe of invention also, must be assigned to Mr. Tolles. A description of the method will be found on page 149 of the "Annual of Scientific Discovery," for 1866–7.

Wm. A. Rogers.

Harvard College Observatory, May 20, 1880.

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Rhizopods—Where to Find them and How to Collect them.

From the magnificent work of Dr. Leidy, recently issued, we extract the following lucid directions in regard to the practical part of a most interesting subject of study:

Localities of Rhizopods.—Fresh-water rhizopods are to be found almost everywhere in positions kept continuously damp or wet, and not too much shaded. They are especially frequent and abundant in comparatively quiet waters, clear, and neither too cold nor too much heated by the sun, such as lakes, ponds, ditches, and pools. They are also frequent in wet bogs and savannas, among mosses, in springy places, on dripping rocks, the vicinity of waterfalls, springs, and fountains, and in marshes, wherever the ground is sufficiently damp or moist to promote the growth of algæ. They are also to be found in damp shaded places, among algæ, liverworts, and mosses, about the roots of sedges, rushes, and grasses, or those of shrubs and trees growing in and at the borders of bogs and ponds, or along ditches and sluggish watercourses. They are likewise to be found with algæ in damp shaded positions in the depressions and fissures of rocks, in the mouths of caves, among decaying logs, among mosses and lichens, on the bark of growing trees, and even in the crevices of walls and pavements about old dwellings and in cities.

The favorite habitation of many kinds of rhizopods is the light superficial ooze at the bottom of still waters, where they live in association with diatoms, desmids, and other minute algæ, which form the chief food of these little creatures. They never penetrate into the deeper and usually black mud, which, indeed, is almost universally devoid of life of any kind.

Rhizopods also occur in the flocculent materials and slimy matter adherent to most submerged objects, such as rocks, the dead boughs of trees, and the stems and leaves of aquatic plants. A frequent position is the under side of floating leaves, such as those of the pond-lily, *Nymphæa odorata;* the spatter-dock, *Nuphar advena;* and the Nelumbo, *Nelumbium luteum.* Certain kinds of rhizopods, especially the Heliozoa or Sun-animalcules, are most frequent among floating plants, such as duckmeat, *Lemna;* hornwort, *Ceratophyllum;* bladderwort, *Utricularia;* and the various confervas, as *Zygnema, Spirogyra oscillatoria,* and the water-purse, *Hydrodictyon.*

In no other position have I found rhizopods of the kind under consideration in such profusion, number, and beauty of form as in sphagnous bogs, living in the moist or wet bog-moss, or *Sphagnum.* Sometimes I have found this particular moss actually to swarm with multitudes of these creatures of the most extraordinary kinds and in the most highly-developed condition. A drop of water squeezed from a little pinch of bog-moss has often yielded scores of half-a-dozen genera and a greater number of species. Frequently, however, the *Sphagnum* of many localities contains comparatively few rhizopods, though I have rarely found them entirely absent from this moss. Other mosses and liverworts I have not observed to be specially favorite habitations of rhizopods, not even such aquatic kinds as the *Fontinalis.*

Collection of Rhizopods.—The mode I have habitually adopted for collecting rhizopods, which is also equally well adapted for collecting many other microscopic organisms, plants, and animals, is as follows:—

For ponds, ditches, or other waters, I use a small tin ladle or dipper, such as is commonly employed for domestic purposes. Into the handle I insert a stick of convenient length, and for this I usually carry with me a jointed pole of two or three pieces, each about five feet. The dipper is used by slowly skimming the edge along the bottom of the water so as to take up only the superficial portion of the ooze, which is then gently raised from the water and transferred to a glass jar. A small hole in the bottom of the ladle favors the retention of the collected material, but care should be taken that it is not so large as to permit the material to stream through. After the collecting jar is full, if more of the material is wanted, after allowing that in the bottle to settle, I pour off a porton of the water and supply an additional quantity from the locality.

Usually I have proved more successful in obtaining rhizopods from the ooze near the shores of lakes and ponds than I have in deeper water; but this, I suspect, was mainly due to the circumstance that near the shore I could see the ooze at the bottom of the water, and could much better manage to collect the desired material.

Aquatic plants, if rooted in the mud, should be carefully cut off and gently lifted from the water so as to disturb as little as possible the adherent materials. A sufficient quantitity being placed in a tin preserving can or other vessel, water from other portions of the plants may be squeezed upon that which is retained.

Wet *Sphagnum* may be collected and put in tin preserving cans, and the water of other portions may be squeezed upon the portion preserved. The same process may be pursued with other mosses.

From the surface of the ground in wet places to collect the rhizopods, it is sufficient to scrape up with the broad blade of a knife the green algous material with which the animals are usually associated.

Third Corpuscular Element in the Blood.

In a paper read before the Birmingham Philosophical Society, Dr. Norris describes a research on a "third corpuscular element" which he believes to exist normally in the blood. He propounds an entirely new view regarding the histology and growth of the blood-corpuscles. He concludes that in normal mammalian blood there are certain colorless, invisible, biconcave disks, similar in every respect to the red corpuscles, with the exception of the absence of color; that these corpuscles exist in the blood in large numbers, and that they are, in fact, an earlier stage of the red corpuscles in which they have not yet obtained hæmoglobin. He further considers that they are lymph-corpuscles which have assumed a biconcave form immediately on being introduced into the current of the blood. Between the two kinds of biconcave disks (the ordinary red and Dr. Norris's invisible corpuscles), others, having every intermediate gradation of color, are demonstrable. The author states that he has been able to observe the conversion of the discoid lymph-cell into a biconcave corpuscle. He is entirely opposed to the current view that the white corpuscle of the blood is a nucleated cell; he considers it to be a mere "accidental aggregate of adhesive lymph-corpuscles," the false appearance of nucleation being caused by *post-mortem* changes.

Mrs. Ernest Hart, in a critical note on Dr. Norris's research, very justly observes that the author's methods are open to the objection of tending to produce artificial appearances. Three methods by which the "colorless corpuscle" is rendered visible were: 1. By changing the refractive index of the serum by the addition of a saturated solution of common salt. 2. By withdrawing the serum from the corpuscles by the method called "packing." 3. By withdrawing the corpuscles from the serum by the method described as that of "isolation."

As to the first, Mrs. Hart calls to mind the fact that the solution of sodium chloride causes many blood-corpuscles to lose their hæmoglobin, and thus assume the appearnce of Dr. Norris's "invisible corpuscle." Regarding the method of packing she points out that the corpuscles are here subjected to an extreme degree of pressure, which causes certain of the corpuscles to discharge their hæmoglobin and to become transparent. The method called by Dr. Norris "isolation," again does violence to the delicate structure of the red blood-corpuscles, so that many of them have the appearance of being ruptured, and of having lost their contents. Hence she concludes that the reality of Dr. Norris's third corpuscle as a normal constituent of living blood is extremely doubtful.—*Lond. Med. Record.*

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

San Francisco Microscopical Society.—The semi-monthly meeting of this society was held on the evening of February 19th, President C. Mason Kinne in the chair.

Messrs. Harkness and Moore, members of the society, presented to the library a copy of "The Catalogue of the Pacific Coast Fungi," compiled by those gentlemen, making at the same time a statement of the work done in that direction during the last four years. The President called attention to the great value of this work, containing, as it does, not only a large number of named varieties, but nearly ninety new species.

Donations were made to the cabinet by Mr. D. W. Grant, of Diatomaceous earth from Napa Valley, and three slides of this material mounted and presented by Mr. William Norris, which were found to be beautiful and very rich in diatoms.

Mr. George C. Hickox, of San Francisco, was proposed for resident membership.

Dr. S. M. Mouser, to whom the material received by the society from Dr. Rex, of Portland, Oregon, and brought to San Francisco by Mr. Hanks, was referred at the last meeting, reported that he had made an examination of it, and found undoubted specimens of the trichina, although the material was in a bad condition. He presented a mounted slide, which was examined by the members of the society, and trichina spiralis fully identified.

Mr. H. G. Hanks stated that the California State Geological Society had received a meteorite weighing 128 pounds from San Bernardino county, which, as far as known, is the second one found in the State; and invited the members to call at his laboratory to see it, promising that the society should have mounted slides of it when cut.

Under the head of "Written Communications," Mr. Hanks read a paper on "Rusty Gold," which will be found in another part of the journal.

A letter was read from Mr. C. H. Denison, the Recording Secretary (who is confined to his bed from sickness), with reference to printing the proceedings of the society in pamphlet form, etc., which matter was laid over until Mr. Denison's recovery.

President Kinne called upon all the members of the society to prepare, and read, original papers on the various branches of Microscopical Science, of which they individually make special study. The idea was suggested by him that the study of living diatoms might throw valuable light on the laws governing the growth of plants. Other subjects of equal interest might be mentioned.

Dr. Harkness strongly urged each member to select some subject for special study. He called attention to the aphidians on the Pacific Coast; also to the galls on trees, which are caused by the Cynips. Original papers on both or either of these subjects would be exceedingly valuable and interesting.

The regular semi-monthly meeting of the San Francisco Microscopical Society was held at their rooms, March 18th, 1880, at which the prompt appearance of members gave evidence of their increasing interest in microscopical science; President Kinne in the chair.

A donation to the library was received from the Royal Microscopical Society of Great Britain, and a mounted slide of diatoms from Vice-President Norris, of earth from Virginia City, Nevada, was added to the cabinet. Mr. Norris reported that the earth contained Melosira and Navicula. Mr. Norris also exhibited a slide of some earth lately received from San Luis Obispo, Cal., which, from a cursory examination, he thought was similar to the celebrated Santa Monica earth. He was requested to make a careful examination and report at a subsequent meeting. Samples of the earth were also sent to Professor H. L. Smith, of Hobart College, New York, for his examination.

Should this earth prove to be of the same composition as that discovered near Santa Monica by Mr. Woodward, it will be of the greatest interest to microscopists, as the society has received a large number of applications, from all parts of the world, for samples of it. The material purchased by Dr. Mead Edwards for microscopical uses and examinations, has been removed from the storehouse to the society room, where it will be arranged and made available for use. Besides 3,000 mounted specimens on glass slides, the purchase contains diatomaceous earth from nearly every country on the globe, besides thousands of phials containing dredgings and marine algæ upon which diatoms are found.

The members of the society have purchased this material at their own expense, and, in scientific circles, are credited with their commendable zeal; a New York scientific journal declaring that the publications of the society, by its first Secretary (Colonel C. Mason Kinne), "*did more to foster microscopy than any other literary agency in the country.*"

At this meeting Dr. Mouser read a letter from W. A. Abel. Esq., of Syracuse, N. Y., and his report upon the subject-matter brought out some interesting information on the subject of monomania. After an interchange of opinions upon various scientific topics of the day, the society adjourned.

The regular meeting of the San Francisco Microscopical Society was held at the society room, May 6th, 1880, President C. Mason Kinne in the chair, and a large number of members present. General A. M. Winn was present as a visitor. Additions to the library, of various publications, were made, and a donation from the Royal Microscopical Society of Great Britain, of a copy of their journal, was received with pleasure.

The President announced, to the great satisfaction of the members of the society, that more of the celebrated "Santa Monica earth," or some similar to it, had been discovered. The deposit is about seventy miles from the spot where the original piece was first discovered by Mr. T. P. Woodward, two years ago. The present theory is that the former piece became detached from the main deposit, was washed into the sea, and then carried by the tide to the shore on which it was found. Professor H. L. Smith, of Geneva, N. Y., reports by letter read by the President, in regard to this deposit, that he has tried the "*new find,*" and finds it so rich and so nearly like the "Santa Monica," that he desires a quantity, so as to be able to supply the demand. Mr. Norris and ex-President Hyde have also made a careful examination of the material, and the former presented a mounted slide which showed forms of great beauty and fully as rich as the original of two years ago.

Scientists all over the world, it is to be hoped, can now be supplied with this very interesting material, for which they have been so anxious.

A communication was received from Professor Joseph Le Conte, and placed on file. The Secretary was requested to assort, examine, and report upon the material purchased of Dr. Edwards at the next meeting. A letter was received from Henry Edwards, Esq., honorary member of the society, giving his Post Office address and announcing his removal to New York. Melville Atwood, Esq., contributed a paper of great value, which will appear in our next issue. In the discussion on this paper, Mr. Hanks remarked that it was a mistake to suppose that a rock section must be cut so thin as to be wholly transparent. In some cases this is necessary; but, as a general rule, the section should be left as thick as possible, and strongly lighted by the aid of a parabolic reflector. The beauty of many specimens is destroyed in the effort made to fit them for observation by simple transmitted light.

Mr. Atwood's plan to cement the section to a glass slide, and to examine it from time to time under the microscope as the work progresses, is very important, as it will enable the student to stop at the exact point when light can be passed through it, but before many of the most interesting features are destroyed by over-cutting.

The readers of Mr. Atwood's paper cannot realize the beauty and importance of these sections unless they can see them under a first-class binocular microscope, and lighted by Wenham's parabola.

The meeting adjourned at a late hour.

Wellesley College Microscopical Society.—The regular meeting was held Monday evening, May 24th, the President, Miss Hayes, in the chair. Miss Clark read a paper on starch, giving the theories of growth and the different characteristics of the starch grain in different vegetable substances. This was illustrated by blackboard drawings of the starch grain, the potato, bean, corn, buckwheat, rice, oats, and arrow-root. She then gave a very full analysis of the structure of a grain of wheat, illustrated by drawings of the various parts. Under the microscope and the polariscope, slides illustrating the same subject were shown.

M. Virginia Smith, Cor. Sec.

Microscopical Society of Camden, N. J.—At the regular meeting, May 22nd, Isaac C. Martindale gave an interesting talk upon "The Germination and Growth of Parasitic Plants."

He first drew a distinction between parasitic and epiphytic plants, in that the former feeds upon and the latter lives or rests only, without feeding upon the pieces of the host. Parasitic plants may also be defined or divided into those which have green leaves and those devoid of them, those having them assimilate their own food, while the leafless feed on that prepared by the host plant. They are further distinguished by those which germinate in the earth, and afterwards become parasitic. Those which germinate as parasitic and afterwards pursue an independent existence, and those which germinate, live and die attached to another.

The Common Dodder, Cuscuta Americana, conspicuous in our swamps in the summer, appearing like a copper-colored wire, is an illustration of the first class. Its seeds germinate in the earth, the embryo of which typifies the future growth, being of the form of a spiral.

After the seedling has grown out, it finds some plant to which it attaches itself by little projections or papillæ, which push out of the side of the slender stem and penetrate the woody tissue or fibres of the plant it is destined to feed upon, then the connection with the earth dies, and thereafter all nourishment is drawn from the host through the little root-like suckers. The history of the growth of this plant was traced through the various stages, and an illustration given that while the Dodder was a parasite it might succor or sustain another parasite on itself—a fungus which the speaker had discovered a few years since, near Mt. Ephraim, and which is now known as *Protomyces Martindalii*, so named by Prof. C. H. Beck, of Albany, an authority on this class of plants.

The Flax Dodder is another species of similar habit, formerly destructive in the flax fields of our forefathers, who grew that commodity for "homespun." Several other species were described, and about one-tenth of those known are said to be inhabitants of the United States.

Of the class that germinate on the roots of other plants, and may perfect their growth afterwards independently, a large number of instances were given, admirably illustrated by dried specimens from the large herbarium of the lecturer, some natives of this country, others from Europe, Asia, and Africa.

A very handsome specimen of the so-called snow plant of the Western Sierras was exhibited and its habits of growth, etc., described.

Schweinitzia odorata, a rare plant (parasitic), was shown as perpetuating the name of Van Schweinitz, who spent a large part of his life in the study of the lower forms of vegetable life.

The large order of *Orobauche* was illustrated by numerous species, and detailed descriptions of the life history of the curious plants were given, and many interesting facts related.

The wrapt attention paid to the lecture must have been gratifying to the speaker, as an assurance that the labor of many tedious hours, the fatigues and disappointments of many a weary search in collecting these facts and specimens, afforded so much instruction to those seekers after knowledge, whose eager faces showed their appreciation.

At its conclusion, remarks upon it were made by several members, and the attention of the audience called to those interesting parasitic plants or micro-fungi, *Cluster Cups*, of which large numbers and different species were shown and explained by the members under the microscope.

The meetings of the society constantly increase in interest, and the attendance on each "visitors'" night grows larger and larger.

The Central New York Microscopical Club.—A regular meeting of the club was held on the evening of Tuesday, May 25th, at the office of Dr. Robert Aberdein, in Syracuse, President Collins in the chair.

The first of the regular work appointed for the evening was an exhibition, by Dr. B. W. Loomis, of "free-hand" sections of vegetable stems, beautifully cut by himself, followed by a demonstration of his method of staining the same with aniline violet in acetic acid. The operation was quickly performed and the results good.

Next in order was an informal talk by Dr. C. E. Slocum on the uses of the microscope in medical jurisprudence. The subject being of such a wide scope, all that was attempted at this meeting was a general outline of the subject, with some remarks on the corpuscles of different varieties of blood, and also on the structure of human and animal bone.

An exhibition of microscopes and slides, by the members, was then made, after which the meeting adjourned.

The West Chester Philosophical Society Annual Soiree, May 26th.—Two years ago the West Chester Philosophical Society was organized in this borough by a few influential and intelligent men, whose identification with this fraternity gave to it considerable tone even at the outstart; and since that time it has been sustained by persons of equal weight with that of its founders. From the beginning it has been ever active in making close researches into science, and it has taken such means to disseminate the result of its labors that it is the prevailing opinion of almost every one that the existence of an organization of this kind has a salutary influence, not only upon the citizens of the town, but also upon the inhabitants of the entire county. Feeling conscious, no doubt, that their many previous meetings have been both profitable and interesting, the members of the Philosophical assembled in their rooms to celebrate the second anniversary since the formation of the society. It is needless to say that this scientific rendezvous was literally crowded. In fact, the addition of Mr. Hartman Naylor's suite of rooms to those of the society were hardly sufficient for the display of the microscopes, and for the accommodation of the visitors. Two hundred and seventy-five tickets of invitation were sent to the friends of the society. Among the recipients of the same were the members of the Camden (N. J), and the Lancaster Microscopical Societies; the former was represented only by a number of its instruments, while the latter sent several microscopes by means of the following-named members: Prof. J. P. McCaskey, E. W. McCaskey, B. F. Saylor, J. H. Rile, W. F. Duncan, C. A. Locher, and J. D. Pyott. Among the many other things that attracted the attention of the visitors was a microscope brought by the Lancaster Microscopical Society, which is supposed to be over one hundred years old, and, of course, is of foreign manufacture. It was sent to London for repairs in 1827, and the bill for the necessary renovation amounted to £2 4s. 6d., which would seem rather high when the instrument is compared with its modern neighbors.

The number of microscopes was very large, and the objects were of great beauty and interest, but want of space precludes our enumerating them.

Lancaster Microscopical Society. — The membership of this society numbers upwards of fifty. When it is taken into consideration that the society is but ten weeks old, this is remarkable. The number of instruments now owned by members of the society is fifteen, all of them first-class instruments, with pretty full list of accessories. "Beck's National" figures prominently among them. Their meetings are held every Tuesday evening at eight o'clock. The first Tuesday of each month is the business evening; the other meetings are open to visitors who are fortunate enough to secure passes, none being admitted without. The meeting *every* Tuesday evening instead of twice a month is an idea of the President's. He wishes to keep up the interest among the members, and have the influence of the society plainly and continually felt in the community, and in this he has certainly succeeded.

At a recent meeting there were a hundred or more guests present, tickets having been issued only to as many persons—in addition to the active and contributing members—as could be comfortably accommodated. Some thirteen microscopes were on duty, showing a great variety of interesting, and beautiful, and wonderful objects, in both ordinary and polarized light. These objects were but a small part of what the society has already accumulated. In addition to those shown on mounted slides, others were exhibited in living animal form, or from fresh or recently plucked flowers and plants. Among the visitors present were some of our leading and most wide-awake citizens, representing lawyers, clergymen, doctors, and the skilled mechanics from the Lancaster Watch Factory, who have made mechanism a fine art in no degree inferior to that of the microscope builders themselves.

After a practical address on Taxidermy, illustrated by actual operations on a small bird, the members gave an exhibition of microscopical objects. This gave great pleasure to the entire audience, many of the objects being exceedingly beautiful, interesting, and instructive.

State Microscopical Society of Illinois.— The annual meeting of the State Microscopical Society of Illinois was held at the Academy of Sciences, 268 Wabash Avenue, Friday evening, April 23d, 1880.

The Treasurer's report showed a highly satisfactory financial condition, about $200 having been paid in during the past year, while the expenditures were less than $50.

The following papers have been read before the society since the semi-annual meeting last October:

"Recent Microscopical Work," by James Colgrove.

"The Microscopical Examination of Signatures," by Lester Curtis.

"The Microscopical Examination of Dust," by A. C. Thomas.

"A New Observation on the Histology of the Fœtal Lung," by Lester Curtis.

"The Microscopical Examination of Tissues after the Administration of Mercury," by S. V. Clevenger.

"The Study of the Cell, with reference to the New Theory," by Lester Curtis.

"Plant or Animal?—A Popular Description of some of the Myxogastric Fungi," by the Secretary.

"Notes on Micro-Lithology," by A. C. Clark.

"The Intra-ovular Life of the Chick," by C. H. Kimball.

The following gentlemen were elected: President, B. W. Thomas; Vice-Presidents, Lester Curtis, M. D., Prof. E. F. Bastin; Secretary, E. B. Stuart; Corresponding Secretary, James Colgrove; Treasurer, W. H. Summers; Trustees—Prof. E. J. Hill, Dr. S. J. Jones, Dr. F. W. Mercer, H. M. Thompson, and Chas. Boring. E. B. STUART, Secretary.

Griffith Club of Microscopy (Detroit).—At the regular meeting, June 2, an exceedingly interesting demonstration on the subject of crystallization was given by the President, Prof. E. W. Wetmore, who illustrated the subject by allowing various solutions to crystalize under the microscope. Prof. Wetmore, Fred H. Seymour, and Prof. Chas. H. Stowell were appointed a committee to arrange for a public entertainment, where, by the use of a stereopticon, with a microscope attachment, a great variety of microscopical objects can be enlarged and thrown upon a screen, so as to be seen by a large audience. They propose in this way to show crystals forming, polariscope objects, circulation of the blood, the pulsations of a frog's heart, and many forms of living animalculæ. This entertainment is to be given in about two weeks.

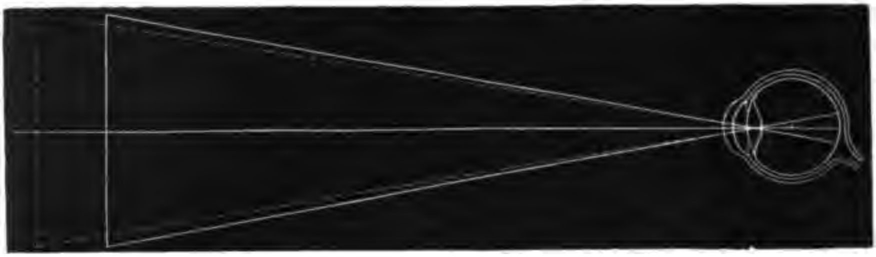

Fig. 1.

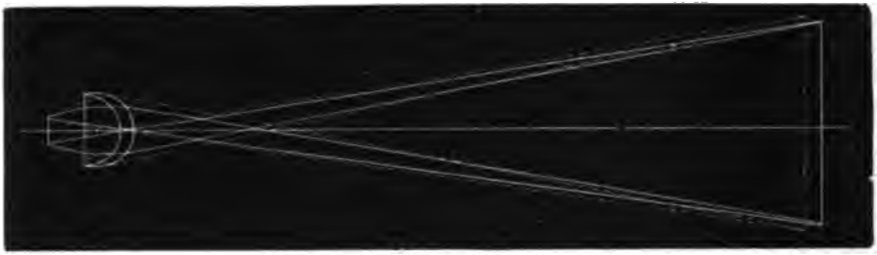

Fig. 2.

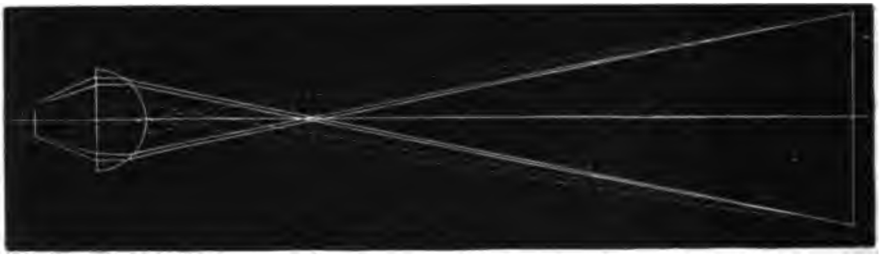

Fig. 3.

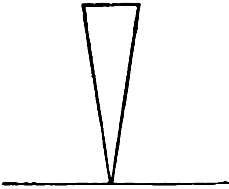

Fig. 5.

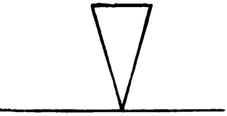

Fig. 4.

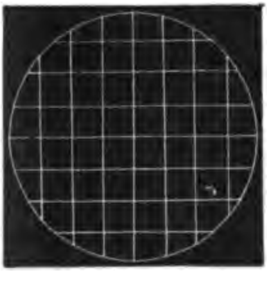

Fig. 6.

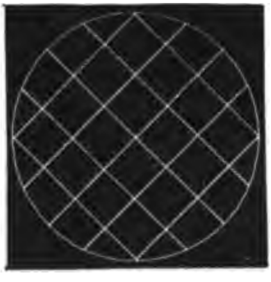

Fig. 7.

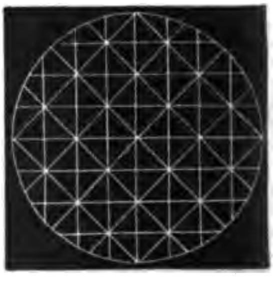

Fig. 8.

PENETRATION IN MICROSCOPE OBJECTIVES.

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Penetration—A Contribution to the Study of the Subject.*

BY GEO. E. BLACKHAM, M.D., F.R.M.S.,
Honorary Member of the Rochester Microscopical Society, etc., etc.

AT the meeting of this Society, held in February last, I had the pleasure of listening to an excellent paper on "The Microscope and its Parts," in which my friend, Mr. Edward Bausch, with a liberality only too rare among practical opticians, gave us the results of his studies and labors for the improvement of our favorite instrument.

After the paper had been read, and for the purpose of stimulating discussion, Dr. Rider spoke substantially as follows:

"I believe it has been claimed here, that penetration, or depth of focus, is a fault, rather than a merit, in objectives for the microscope. Now, the human eye is possessed of considerable penetration, and Prof. Helmholtz has said of it, that had he received from an optician an instrument so faulty as the human eye, he would have sent it back to be properly constructed. In spite of these theoretical faults, perhaps, indeed, because of some of them, the human eye is an instrument of great practical value, and it is a question if we should require our artificial optical instruments to be free from the theoretical error of penetration which is found to be of great practical value in the human eye. In other words, admitting that an objective, possessed of considerable penetration, is theoretically faulty, may it not be, for many practical purposes, of more value than one not possessed of penetration."

I do not understand that in offering these remarks, Dr. Rider intended to put on record his own opinions on the subject, but that he merely threw them out to stimulate a discussion which, however, owing I think to the lateness of the hour, was much more brief than I could have wished.

Dr. Rider's remark's, however, seem to me to formulate so admirably the current objections to what I believe to be the true view of this subject, that I have taken them for the text of the present paper, in which I propose to discuss the subject on first principles.

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* Read before the Rochester Microscopical Society, April 12th, 1880.

Before discussing a subject, however, it is well to know just what it is we are to discuss. What then is Penetration in a Microscope Objective?

Frey, in "The Microscope and Microscopical Technology," Cutter's translation, New York, 1872, makes it synonomous with resolving power, and says it varies directly as the angle of aperture.

Dr. W. B. Carpenter, "The Microscope," 4th Edition. London, 1868, (p. 171,) says:

"The Penetrating power, or, focal depth, of an object glass, (good definition being, of course, presupposed) mainly depends upon the degree of distinctness with which parts of the object that are *a little out of focus* can be discerned; and this will be found to vary greatly in different objectives, being within certain limits in an *inverse* proportion to the extent of the angle of aperture."

Here are two radically different, even opposite, definitions of the same term.

Dr. Carpenter's is the one most consonant with the ordinary meaning of the word penetration, is the one generally accepted by English speaking microscopists, and is the one to which Dr. Rider referred in his remarks, and which I shall adopt in the present paper.

Now, in examining Dr. Rider's statement, I find the following propositions either stated or implied.

1st. The human eye is not theoretically perfect from an optical point of view.

2nd. That in spite of these imperfections, or perhaps, indeed, *because* of them, the human eye is an optical instrument of great practical value.

3rd. That among the theoretical imperfections, penetration or depth of focus is one.

4th. That, therefore, we may infer that an objective with this theoretical defect will be of more practical value than one free from it.

To these propositions I reply.

1st. That I admit that the normal human eye is theoretically imperfect.

2nd. I also admit that in spite of these imperfections (but *not because* of any of them,) it is an optical instrument of great practical value.

3rd. That the human eye is possessed of penetration to a much less degree than is generally supposed.

4th. That the optical conditions in regard to the relative distances of the object and image being exactly reversed, it does not all follow that, admitting that a certain amount of penetration is legitimate, proper, and useful in the eye, the same is true in regard to a microscope objective.

To illustrate my 4th, proposition, let us consider first the conditions of penetration in an optically perfect eye, and objective respectively. Here the object is at a considerable distance from the optical centre of the eye, not less than ten inches, generally speaking, and often much more, while the image is at a very short distance, something less than an inch. Hence the image is much smaller than the object, and hence also two planes at right angles to the line of vision or optic axis of the eye, which are separated by a considerable distance in the object, may be so approximated, by mere reduction of size, in the image, as to be brought to practically one and the same visual plane upon the retina. (Fig. 1.)

In the case of the microscope objective, however, these conditions are just reversed; here the object is small and is situated in the short conjugate focus, and the enlarged image is situated in the long conjugate focus, (Fig. 2,) and hence two planes which are close together in the object must be much more widely separated in the image, and this in exact proportion to length of the posterior conjugate focus, as compared with the anterior. Hence, also, in a theoretically perfect objective (the posterior conjugate focus being assumed as fixed at ten inches) the amount of penetration, that is, the distance between two planes of the object which can be near enough to the same focal plane in the image to be seen clearly and distinctly at one and the same time, must be very small, and will vary directly as the length of the anterior conjugate focus, or approximately as the working distance. To this it may be replied, that no objective is theoretically perfect, and that some objectives have considerable penetration in proportion to their working distance; and that these objectives have been highly commended by Dr. Carpenter and other high authorities.

This is admitted. Let us now investigate how this depth of focus may be produced.

If we take an objective whose spherical aberration is under corrected, and project rays from the plane of the eye-piece, we shall find that those falling upon the peripheral portion of the front lens are brought to a focus sooner than those falling upon the central portion (Fig. 3), and hence, that rays from a plane of the object closer to the front lens, falling upon the peripheral portions of it, will be brought to a focus in the same plane of the image as rays from a more distant plane of the object falling upon the central portion of the front lens, and the distance between the two planes of the object which can thus be brought to a common focus at the eye-piece, or, in other words, the amount of penetration of the objective, will be directly proportionate to the amount of spherical aberration in the objective which has been left uncorrected.

Now, this combination of two different images (for two layers of a microscopic object are seldom, if ever, absolutely identical) into one, can only result in the melting together (*con-fusion*) of the images and a resulting loss of definition.

Dr. Carpenter, (*loc. cit.*) has said, "The defining power of an objective mainly depends upon the *completeness of its corrections*, both for spherical and chromatic aberration; and it is an attribute essential to the satisfactory performance of any objective, whatever be its other qualities."

How he can reconcile this with his other statement that "The want of focal depth is a serious drawback in the performance of many objectives which are distinguished by the possession of other admirable qualities," I do not know, and it is not my purpose, at this time to inquire.

We have now seen that penetration in an aplanatic combination, is dependent upon, and exists in direct proportion to the ratio between the distance between the optical centre of the lens and the object, (or anterior conjugate focus) and the distance between the optical centre of the lens and the image, (or posterior conjugate focus), the anterior conjugate focus being the dividend, and the posterior conjugate focus the divisor, and that with any given relation between the conjugate foci in an imperfectly corrected lens, the amount of penetration increases with the amount of spherical aberration, and decreases in proportion as the corrections for spherical aberration approach perfection, also that penetration produces a melting together or confusion of images, and a necessary loss of definition.

Let us now see what provision the human eye has to prevent this lamentable occurrence—in other words, what are its corrections for spherical aberration.

Spherical aberration is caused by the fact that rays falling more obliquely on the lens near its periphery than at its centre, are more strongly refracted than those falling nearer the centre, and are consequently brought to a focus sooner. One method of correcting this error, (made use of in uncorrected lenses like Wollaston's doublets), is to cut off the extreme marginal rays by means of a diaphragm with an opening in the centre, and this device we find in its most perfect form in the iris, an adjustable diaphragm, whose variable central opening forms the pupil of the human eye. Another device is to render the refracting power greater in the centre of the lens. In the microscope we can only do this by means of negative concave lenses of flint glass, in which, by reason of their concave form the greatest negative refracting power is at the periphery, thus neutralizing the greater positive refracting power of the peripheral portions of the crown glass convex lens. In the human eye, however, we find an arrangement which has never been successfully imitated, that is, the greater refracting power of the peripheral portion of the crystaline lens, which results from *position* is neutralized by the greater refracting power of the central portions resulting from structure, or in other words, the spherical aberration of the crystalline lens of the normal human eye is corrected by a gradual increase of density and refracting power from the periphery to the centre.

Having thus shown that the human eye is, in part, at least, corrected for spherical aberration, the question arises, whence its power of penetration? I reply, that it is much less than is generally supposed. A part is accounted for by the relatively great distance of the objects as compared with that of the image upon the retina, but the major portion is due to an optical illusion dependent upon the rapidity with which the accommodation can be unconsciously varied, and to the persistence of impressions upon the retina.

When the eye is at rest, unaccommodated, the retina lies in the focus for parallel rays, that is, rays from very distant objects.

If it were not for the power of accommodation, rays from nearer objects would have their focus behind the retina, but by means of the muscle of accommodation, and the elasticity of the lens, its figure is rendered more convex, and its focal length shortened so that rays from nearer objects are brought to a focus upon the retina, instead of behind it. The rapidity with which this can be done is wonderful. A near object can be focussed upon the retina and then a distant one before the impression of the near one has entirely passed away, and vice versa, so that we get the impression that we saw both at once, instead of in rapid succession, and hence get an exaggerated idea of the penetration of depth of focus of the eye. The fallacy can be demonstrated by a simple experiment; thus, on a screen some ten or twenty feet distant, place a card of test type of just such size as can be clearly read at that distance, then close one eye and hold before the other at arms length between the eye and the test type, a common lead pencil, and try to read letters on the type card and the lead pencil simultaneously. It can not be done, but the change of accommodation from one to the other can be made almost unconsciously and with surprising rapidity. If, however, the experiment be long continued, the muscle of accommodation becomes wearied with its rapid work, and the demonstration becomes more vivid.

Thus we have seen that while the amount of penetration of the normal human eye is by theory much greater than that for a properly corrected microscope objective, it is really much less than is generally supposed, so that the amount proper for a good objective must be very small indeed, and in this I have for the sake of simplicity, purposely left out of consideration the action of the eye-piece of the microscope, which would still further diminish the appropriate penetration of the microscope as a whole.

So much for a purely theoretical investigation of our subject. If I have carried you along with me logically thus far, some doubting Thomas may still say, Theoretically, that sounds all right, but practically, may not penetrating objectives be best after all? Dr. Carpenter and other good authorities tell us that they enable us to see the parts of our objects in their true and natural relations, and the great majority of histological work is being done with them today.

To which I reply—the more is the pity—because most of it will have to be done over again with better lenses. The fallacy that penetrating objectives enable us to see different planes of objects in their true relations arises from confounding depth of focus with stereoscopic effect. The first arises, as I have shown, in microscope objectives from imperfect correction of spherical aberration, the second, from the combination of two views of an object from slightly different points of view. With our right eye, we see the front of an object, the same as with our left eye, but a little further round on the *right* side, and with the left eye, the front the same as with the right eye, and the combination of these two images, (which are closely identical as to the parts seen with both eyes,) gives the stereoscopic effect or perception of relief, and is not dependent upon depth of focus. Thus my wide angled 1 inch objective which is possessed of a very small amount of penetration (I am glad to say), gives on such objects as gold crystals, a much greater stereoscopic relief than can be obtained with a narrow angled penetrating objective, because the views obtained through the centres of the right and left halves of the front lens respectively, (Fig. 4), have a greater angular difference than those obtained through the right and left halves of the front lens of the narrow angled inch. (Fig. 5.)

Now, I have here two pieces of wire netting in squares, which we will suppose to represent two contiguous layers of structure in an object. With a corrected objective, you see the upper one first, (Fig. 6,) and (following nature's plan with the eye,) you focus down through it, and see the other with its lines running diagonally to those of the first (Fig. 7). Now let us bring them together so as to see both at once, as a penetrating objective would do, and what is the result—we get a compound figure, (Fig. 8,) totally unlike either, and thus we get one of those illusions of sight of which Dr. Rider spoke so eloquently and truly on the 5th of February last, before the Y. M. C. A., of this city. Nay, worse, if we have accepted the teaching of Carpenter and others, that penetrating objectives are the ones which show us things in their true relations, the *il*lusion becomes a *de*lusion, and we accept a false appearance for a fact, and science suffers, and the practical observer who regards with ill-concealed contempt these discussions on angular aperture and penetration, etc., etc., as mere mint, anise and cumin, goes on observing and recording error for fact, error for fact, error for fact, till it would seem as though in Descriptive Histology the whole head must be sick and the whole heart sore.

For it must be remembered that the strength of a chain is only the strength of the weakest link, and that the work of the most eminent histologist must be invalidated, to some extent at least, if he works with imperfect instruments. Meantime, those microscopists who believe there is a Science of Microscopy, who look *into* their microscopes as well as *through* them, regret the hours of patient labor wasted by their so-called "practical" brethren, whose ill-concealed or unconcealed contempt they bear with smiling unresentful confidence in the coming of a day of sure and perfect vindication, whose dawning is already seen in the splendid work of Drysdale and Dallinger, and a few others, which could not be done save with first class objectives.

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— It is said that some of the sarcophagi of ancient Egypt bear the marks of having been hollowed out with tools of the crown or cylinder-saw order.

On the Impregnation of Portions of the Walls, or Enclosing Rocks of the Belvidere Lode, Bodie, With Native Silver, Electrum, and Cerargyrite.*

SINCE I had the honor of becoming a member of this Society, now nearly eight years ago, most of my lesiure time has been spent in the study of microlithology, and I have, during that period, cut and prepared for microscopical examination, a very large number of rock sections; but those marked Nos. 1, 2, and 3, which I now submit for your inspection are, without exception, amongst the most beautiful and instructive that I have made.

The simple mode I use in cutting them, and which I had the pleasure of calling your attention to in my last communication to the Society. I would also strongly recommend to the "Geologist in the Field." I found the great advantage of it in preparing these sections, as it enabled me to watch the operation very closely, to guard against making them too thin, as the character and beauty of the section would then have been destroyed.

The sections marked Nos, 1, 2, and 3, are cut from pieces of the wall or enclosing rock (a much-altered grayish-green Trachytic Diorite), of the Belvidere lode, taken at a depth of about 300 feet below the surface of the ground.

If they are examined by the aid of a good binocular, using a two-third objective and the parabolic illuminator, the native silver in leafy sheets, also the filiform particles of electrum, and grains of cerargyrite will be made to appear as if floating in a glassy and yellowish liquid mass. The cerargyrite grains are surrounded, or fringed, with native silver.

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* Paper read by Melville Atwood, Esq., before the San Francisco Microscopical Society, May 6, 1880.

The forms of some of the altered hornblende, of a yellowish color, are tolerably well preserved, while others show that they have been partially dissolved, and the spaces or cavities so formed, to a certain extent, replaced by silver, small grains of which are to be seen in both the altered crystals of feldspar and hornblende. Minute crystals of pyrites are also visible in the sections, and in the little cells left by the decomposition of some of the pyritic crystals are thread-like pieces of electrum. The impregnation of the country rock from which these sections were taken, I think, took place contemporaneously with the filling of the fissure.

The solutions from which the minerals of the Bodie lodes were precipitated must have been aqueous, otherwise it would be difficult to account for the presence of so large a portion of "wad" which is found mixed in with the veinstone.

The grains of ore from impregnation are generally so minute that they cannot easily be recognized by the naked eye, so that under any circumstances they are better viewed by the aid of a good microscope.

The piece of quartz marked No. 4 is from the Belvidere lode, and, if dipped in water and then examined with a good lens, the electrum, or Bodie gold, will be seen in beautiful thread-like particles throughout the whole mass.

No. 5 is a piece of "wad" from the Standard lode, Bodie.

Mr. Hanks made a very careful assay of the Bodie electrum, with the following results: Gold, 633·4; silver, 364·1; total, 997·5; specific gravity, 15·15; color, pale yellow, resembling German silver.

No. 6 is a section cut from rock taken from the 500-foot level of the Dudley mine, Bodie, the deepest in position, I think, on the Bodie metalliferous channel.

No. 7 is a section of rock from Gold Hill, taken from a point sixty feet west of the Comstock lode, and at a depth of 3,000 feet.

Mr. Frank Rutley, in his valuable little book on "The Study of Rocks," remarks: "There is, however, a disadvantage attending the use of lenses when they are applied to the examination of rocks. This lies in the difficulty experienced by the observer when he attempts to examine the streak of minerals under the lens, especially when the minerals occur in very minute crystals or patches, as it is scarcely possible to hold a specimen, with a lens over it in focus, in one hand, and to work with a knife in the other. Laying the specimen on the table, and using a lens in one hand and a knife in the other, is a most unsatisfactory process; while the use of a lens fixed on an adjusting stand is scarcely better. To obviate this difficulty, the author has devised a small lens with a clip, which can be worn on the nose like an eye-glass, and both hands are then at liberty—the one to hold the specimen firmly, the other to use the knife or graver. Instead of a clip-lens, I use a watchmaker's eye-glass, fixed with a screw into a light pair of steel spectacle frames, the same as I send for your inspection. I think the botanist, also, will find it a very useful arrangement.

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—Dr. Vogel, of Berlin, in a letter to the Philadelphia *Photographer*, says that old daguerreotypes that have turned yellow, blue, or black, will often become as bright as new if simply placed in a solution of cyanide of potassium.

Pelomyxa Palustris.

LITERATURE.

(1) Pelomyxa palustris. Quarterly Journal of Mic. Science, Vol. 14, p. 97. Abstracted from a paper by Greef, in Jenaische Zeitschrift, 1873.
(2) P. palustris. By R. Greef. Archiv für Mik. Anat. Bd. X.
(3) Rhizopodenstudien. By F. E. Schulze. Archiv f. Mik. Anat. Bd. X and XI.
(4) A System of Logic. By John Stuart Mill, 8th. Ed. 1874.
(5) Primer of Logic. By W. Stanley Jevous, 1876.

NEARLY two years ago, my curiosity was greatly excited by a short notice (1) of a new amœboid form, from which notice I quote a few lines:

"The amœboid masses are large, often dark in color, protruding lobose, hyaline pseudopodia. The ground substance contains numerous nuclei, hyaline, homogeneous, highly refractive bodies, and delicate rod-like bodies. Under certain conditions the pelomyxa mass gives rise to large swarms of minute amœbæ which Greef followed, in some cases, to a flagellate, freely swimming condition."

Not long after reading this short account of what seemed to be a most remarkable organism I had the pleasure of finding a lengthy memoir by Greef (2), and of this I will give here enough to enable you to identify the form, should you be lucky enough to come across it.

"If one observes a pelomyxa under the microscope, with a low power, one sees usually nothing, *at first*, save a dark mud lump; but if the eye attentively examines the periphery of this lump, it sees, here and there, hyaline protuberances, now lobose, now hemispherical, often indeed running along the edge in a wave-like manner." Fig. 1 shows these very characteristic pseudopodia unusually well developed around a small part of edge as seen in optical section.

"After these motions have continued for a time, there suddenly breaks forth at some point, a broader process, into which now, the contents stream as into a sack, pushing it forward and expanding it. The process becomes thereby, often filled with a great part of the contents, and is, in fact, a huge lobose pseudopodium Other processes are soon after evolved, and we soon see the transformation of a mud ball into a variously lobed body which moves like an amœba."

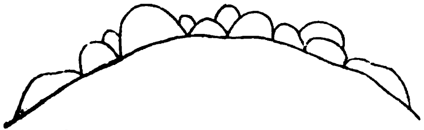

Fig. 1.

The ordinary P. is far two opaque to allow of its structure being investigated, but if we examine a tolerably transparent specimen the following structure may be demonstrated. We first distinguish two principal elements: (1) an outer, clear, transparent *ectosark*, and (2) an inner frothy *endosark*, containing a great number of vacuoles. In this endosark are found three kinds of bodies which are characteristic of P. They are (1) Nuclei, (2) "Shining Bodies," (3) Minute Rods. The nuclei occur in great numbers. They lie *irregularly* between the vacuoles. "One can easily count several hundred in a one-millimetre specimen." Their shape is usually spherical and in the hyaline interior, are more or less numerous dark granules which usually lie next the membrane or wall of nucleus.

"The smallest 'shining-bodies,' have a diameter of only ·006 mm., the largest a diameter of ·06. Between these extremes one finds almost all sizes in a single P."

They consist of a strongly gleaming case (Kapsel) the contents of which are usually hyaline and homogeneous throughout. Iodine colors them an intense brown, and they increase by division.

The "small rods" are hyaline, sometimes longer, sometimes shorter, but in general not over ·006 to ·008 mm., in length. Their surface is smooth and they appear to consist of an organic substance and to be characteristic of Pelomyxa.

Pelomyxa can be divided into any number of parts and each part lives and acts as did parent mass.

Fig. 2 represents, in merest outline, the creeping out from body of a dying P. of a host of little amœbæ, which each possess a nucleus with nucleolus and contractile vacuole. These amœbæ, which were all of same size, came in course of an hour, to rest, and, assuming an oval form, put forth a flagellum by means of which they were drawn rapidly through the water. Fig. 3 shows one of the zoospores thus formed, highly magnified.

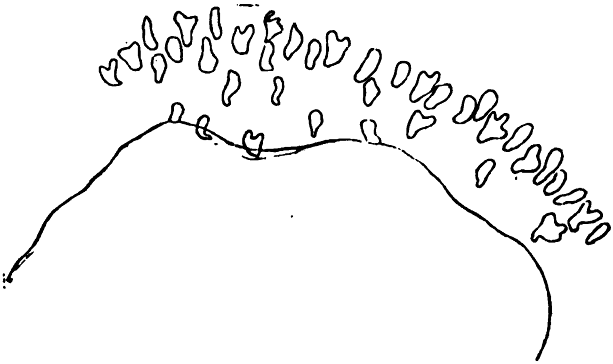

Fig. 2.

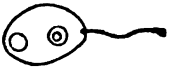

Fig. 3.

This is all I care to give of the memoir of Greef, who discovered this strange form about ten years ago.

The next observer who has written on Pelomyxa, Schulze, (3) has very little to say, save as regards its mode of motion. He, however, observed a *self division* of the whole organism and says that he found no black or dark brown P.s, but only whitish or light yellow ones.

This has been my own experience, and although I have not found more than one or two examples sufficiently transparent for thorough study, yet, of the two or three hundred P's that I have seen, not one has appeared black or dark brown. To the naked eye, they appear almost like pearls, (perhaps by contrast with the black mud in which they are found), and, in fact, when I first found them—in November, 1879, at the head of a mill-pond near by—I took them to be small white stones, polished by action of water, and having an average diameter of an ordinary pinhead. The microscope soon dispelled this illusion, however, and proved them to be precisely what I had long most desired to see, Pelomyxa palustris.

So far as I know there is only one other memoir touching this species, and this I may disregard, as it deals only with the action of light, etc., upon it.

I have been able to verify most of the statements of Greef, and have made out a few points of structure etc, worthy perhaps of brief mention.

It is difficult, in optical section, to detect, with a medium power, any hyaline border (ectosark) but the granules, most of which are large and opaque, making object far from transparent, press close up to the limiting *line* of body. *This line has a distinct double contour* and looks quite like a membrane. Perhaps, I had better give here a definition of double contour in place of which I shall write d. c. If I draw two parallel lines (thus ═══) each line has a d. c., however close together they may be, or however minute be the diameter of each; but if I fill up the space between them, (thus ▬) then the whole object has a d. c.

The d. c. of which I have spoken is seen most clearly at edge of a *hyaline* pseudopodium, and becomes still more pronounced if a little carmine solution with alcohol be introduced, when margin of pseudopodium at once becomes stained. It is usually impossible to flatten out a P. of any size on account of the large grains of sand in interior, but by careful pressure one can often make out considerable even in the worst cases, and as a tolerably transparent specimen is very rare indeed, the only thing to do is to press hard enough to allow of some sort of view of the interior even though the cover-glass be broken into fragments thereby. Such pressure, long continued, often develops, in large P.'s, a peculiar phenomenon. A large thin sheet of what is probably pure protoplasm, slowly appears at one side, sometimes running rapidly out like a huge semicircular pseudopodium, until its diameter is nearly half that of the body proper. Sometimes this very hyaline sheet will travel around edge of body for a considerable distance. This motion is perhaps to be explained by the constant protrusion of pseudopodia at anterior part of sheet, and as constant retraction of like amounts of protoplasm at opposite point. This sheet is not, in all cases, supported by the surface of slide, since we sometimes see a second sheet above the first and not in contact with it. It is evident, therefore, that these peculiar pseudopodia possess, in common with all living matter, considerable rigidity.

That these sheets are not forced out by pressure is probable from the fact that often nothing of the kind is to be seen under ever so great pressure. Often too, one is retracted here, another sent out there, quite after the manner of ordinary hyaline pseudopodia. On such large sheets I have often seen not the least trace of a d. c. At other times they show, while still alive, a perfect d. c. at margin. It happens at times, that a sheet will die while still extended: in no such case have I failed to see at edge of dead sheet a most distinct d. c., even where no trace of one was before visible.

Another change is the appearance in dead sheet of innumerable, fine, pale granules which appear to have been uniformly precipitated throughout a substance which, while alive, was entirely free from them. Of course, there is no longer any trace of motion, where before motion was incessant. Perhaps, in this last fact we have an explanation of the constant presence of d. c. on dead sheets, and its inconstant presence or absence on living sheets. If we suppose the d. c. to be merely the optical expression of an *increased density* of outermost layer of ectosark, which is due to action of water on what is essentially a homogeneous mass, and that this density is lost on removal from water contact, it is evident that no d. c. could become visible at margin of a pseudopodium in motion, unless the motion were such that the same particles of protoplasm remain for some time in contact with water. But it must often happen that no molecule of a moving pseudopodium remains for long in the same place, and therefore the d. c. may often be absent from living, never from dead sheets.

In the case of any amœboid organism, the distinction between *pseudopodium* and *body* is apt to be very vague. There is no such difficulty with the Heliozoa, but between them and amœboids there are all possible transition forms until we arrive at a form wherein the distinction ceases to be of any importance. Such a form is Pelomyxa, so long as we leave out of sight those *hyaline* protuberances which, though peculiar in shape, and not concerned with locomotion, we may call pseudopodia. It is simply a *formless* speck. It is true that Greef calls any lobose process a pseudopodium, even if it be as large as the whole body. For the sake of convenience I may do the same although I do not think it quite accurate. What now is true of these pseudo-pseudopodia (which differ in no respect from any portion of the body proper) as regards this double contour? *Where there is much of any motion to ectosark there is apt to be no d. c.*, and I am tolerably certain that I have seen all transitions from perfect d. c., to none at all, and change of latter to former condition. That which I have called "the d. c. of margin in optical section," is simply a curved line in appearance, about equal, in diameter to a large flagellum. Assuming that this line represents something and is not—what it is possible for it to be—an optical illusion, what does it represent?

It seems probable that it is the optical expression of what I may call a *pseudo-membrane.* By this term I would denote any *protoplasmic* structure that has all the optical characters of a true membrane. But the word membrane itself needs definition now and then, and I will give what I regard as the true one, so far as concerns Protobiology. (In Metabiology the word may have a very different meaning.)

"Language, as Sir James Mackintosh used to say of governments, is not made, but grows. A name is not imposed at once and by previous purpose upon a *class* of objects, but is first applied to one thing, and then extended to another and another. By this process a name not unfrequently passes by successive links of resemblance from one object to another, until it becomes applied to things having nothing in common with the first things to which the name was given; which however, do not for that reason, drop the name; so that it at last denotes a confused huddle of objects having nothing whatever in common; and connotes nothing, not even a vague and general resemblance. When a name has fallen into this state, it has become unfit for the purposes either of thought or the communication of thought. Such are the inconveniences of a language which is not made, but grows" (4). "One of the chief sources, indeed, of lax habits of thought, is the custom of using connotative terms without a distinctly ascertained connotation, and with no more precise notion of their meaning than can be loosely collected from observing what objects they are used to denote." (4.) "It is impossible to frame a perfect set of definitions on any subject, until the theory of the subject is perfect; and as science makes progress, its definitions are progressive." (4).

"*By a definition, we mean a precise statement of the qualities which are just sufficient to mark out a class, and to tell us exactly what things belong to a class and what do not.*" (5)

"A connotative term is one which denotes a subject and implies an attribute. By a subject is here meant anything which possesses attributes" (4). In other words, class names denote objects and connote the attributes which all objects, to which the name is applicable, *must* possess. "The definition of a connotative name is the proposition that declares it connotation." (4) *In other words it is a formula which enables one to know of any object (or portion of an object) whatsoever, whether it is to be called by the name or not.*

The above constitutes, in my humble opinion, the best treatment, in brief, of the nature of class-names and definition, anywhere in existence. If there be any such thing as truth, these things are true; and if there be any difference between truths of importance and truths unimportant, these are of the greatest importance to every botanist and zoologist; for the simple reason that Biology is scarcely more than a collection of names, so that anyone, having a perfect understanding of every biological term, would know nearly everything of Biology. W. G. LAPHAM.

Northville, Mich., June 1, 1880.

To be continued.

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—The ordinary thin cover glass, as manufactured by Messrs. Chance & Co., of Birmingham, is ordinary crown glass, having a mean refractive index of 1-5 to 1-525. They have never used flint glass for the manufacture of microscopical covering glass.

On a Means of Obviating the Reflection from the Inside of the Body-tubes of Microscopes, with Suggestions for Standard Gauges for the Same and for Substage Fittings, etc.

BY J. W. GROVES, F.R.M.S.
Demonstrator of Physiology in King's College, London.

I WISH to draw the attention of the Society to a defect common to all microscopes, but which attains its worst development in the instruments made on the Continent. I refer to the fact of the inner surface of the body-tube acting as a reflector, due to the black lining being either imperfectly put on or subsequently rubbed off. In instruments of Continental manufacture, the former cause prevails as a rule, while in English stands, even the best, it will be found that the inside of the tube, soon after, if not at the time of purchase, is more or less bright for a certain distance from the top, corresponding to the length of the lowest or A eyepiece. When the latter is used the best performance of the microscope is obtained, all the bright reflecting surface being covered; but when higher oculars are required, then, as their tubes are shorter, there remains an exposed bright surface, which reflects the light to the eye, producing more or less blurr, which is sometimes so marked that the higher eye-pieces become useless. I therefore propose a very simple alteration in the body-tube, which would entirely do away with the defect.

The body-tube should have inserted in it a short piece of tube, of the same diameter as the eye-piece, but only as long as the one of higest power. The other eye-pieces would then be in contact only with this short tube, and the black lining of the body-tube would not be rubbed, and would therefore remain uninjured.

While suggesting an alteration in the tube, I should like to bring forward a subject in regard to which opticians could confer an immense boon on workers with the microscope, viz. by adopting certain standard sizes for the lengths and diameters of the body-tube, substage fittings, etc. At present the eye-pieces, condensers, etc., of one maker will not fit the microscopes of other makers without special adapters; whereas, if certain standard gauges, say A, B, and C, were adopted it would only be necessary to order whatever might be required for an A, B, or C stand, and there would be a certainty of its fitting.

How many gauges and of what sizes they should be, are questions which could be settled by a committee consisting of some of the English and foreign makers, together with two or three competent workers. By the deliberations of such a committee, under the auspices of this Society some years since, we obtained the Society or universal screw, which, as well as the Hartnack or Continental, are still the usual gauges both here and abroad. I think that the time has arrived when this, as the parent Microscopical Society, should offer facilities for determining the standards for such other parts of the instrument as would enable the apparatus of one maker to be used with the stand of another.—*Journal Royal Microscopical Society.*

[The defect described above by Mr. Groves, is produced in a still greater degree in many microscopes by the draw-tube, where the later slides directly into the body tube without passing through a collar. The defect and the proposed remedy were both described some years ago by the editor of this journal.—Ed. Am. Jour. Mic.].

Synopsis of the Belgian Diatoms.

We have received the prospectus of this work, the general intention and scope of which will be best understood from the following letter written by Prof. H. L. Smith, to our cotemporary, *Science:*

Dr. Henri Van Heurck, the well-known director of the Botanical Gardens at Antwerp, Belgium, proposes to issue a "Synopsis of the Belgian Diatoms," in a series of six numbers, each one to contain about a dozen plates. The division of plates will be such that the great groups of diatoms will be comprehended each in two parts, as follows: I and II, *Raphideæ, Amphoreæ, Cymbelleæ, Naviculeæ, Gomphonemeæ,* etc.; III and IV, *Pseudo-Raphideæ: Epithemieæ, Synedreæ, Surirelleæ, Nitzschieæ,* etc.; V and VI, *Crypto-Raphideæ: Melosireæ, Coscinodisci,* etc. This arrangement is that proposed by Prof. Hamilton L. Smith in the general synopsis of the Diatomaceæ as inserted in the "Traitè du Microscope" (3e édition Bruxelles, 1878), de M. le Dr. Henri Van Heurck.

The price of each plate, accompanied by its description, is 75 centimes (15 cents), to subscribers; to non-subscribers, after publication, the price will be one franc (20 cents), per plate. The numbers will apappear at intervals of three to four months. The text will be published after completion of the plates. It will embrace a description of all the forms hitherto found, or likely to be found in Belgium, indicating localities, etc., and with synoptical tables for determination, etc., etc. The price of this volume is fixed at 7½ francs.

Dr. Van Heurck has sent to me a limited number of specimen plates and the prospectus of above work, which I will be pleased to send to any one taking special interest in the diatoms, and intending to subscribe.

The name of Dr. Van Heurck is a sufficient pledge that this "synopsis" will be issued strictly according to the prospectus, as announced above; and it cannot fail to be very acceptable to every student of these beautiful and wonderful microscopical plants. The "British Diatomaceæ" is now almost beyond reach, and nothing that I know of will so nearly supply its place as Dr. Van Heurck's proposed Synopsis. Besides containing probably all the species described in the "British Diatomaceæ," there will be many not included in that, and embracing by far the greater number of forms found in our own country.

It will give me pleasure to communicate any further information. Address, "Monsieur le Dr. Henri Van Heurck, Directeur du Jardin Botanique, Rue de la Santè, 8, Anvers, Belgique."

I will only add that the plates are heliographic reproductions of enlarged drawings made by Dr. Van Heurck, or by M. Grunner, and that M. Deloyne, of Brussels, proposes to issue a series of diatom preparations, in boxes containing twenty-five slides each, similar to those of my own "Species Typicæ," and in accordance with the synopsis of M. H. Van Heurck.

H. L. Smith.

Hobart College July 1, 1880.

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AND
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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Omission.

BY a stupid oversight we forgot to add to the article on Sponges which appeared in our last, that it was a paper read by H. Mills, Esq., before the Buffalo Microscopical Club, on the evening of April 13th, 1880.

The omission was partly due to the fact that no statement to this effect was found on the paper itself, but we ought to have been thoughtful enough to have added it.

Annual Gathering of Microscopists.

THERE will be two centres of microscopical activity this year—Boston and Detroit. At the latter place will meet the American Society of Microscopists, a young association with all the fire and energy of youth. Although young in years, however, it numbers in its membership the most experienced microscopists of the country, and has concentrated the best efforts and good wishes of all the local Microscopical Societies. The retiring President, Dr. R. H. Ward, of Troy, has long been identified with microscopical progress in this country, and the President elect, Prof. Hamilton L. Smith, is known wherever the microscope is used. We learn that the people of Detroit are making the most liberal preparations to give the Society a cordial welcome, and those who know what Western hospitality is, can readily imagine what a good time every one that goes to Detroit will have.

Boston, on the other hand, is to be the meeting ground of the most eminent men of the country in all departments of Science, for here will gather the members of the American Association for the Advancement of Science. Stirred up, no doubt, by the example of the younger society, that meets at Detroit, but prompted still more by the wonderfully increased interest that is everywhere manifested in microscopy, the Microscopical Section of the Association has exhibited great activity this year, and under the lead of Prof. Lattimore, of Rochester University, the most elaborate preparations have been made.

No person interested in microscopy, can fail to find pleasure and profit at either meeting. Our hope is that no one will play the part of the ass in the fable, and between two such attractive meetings fail to attend either.

Microscopical Soirees.

THE Microscopical Societies of this country have shown great activity during the past year, and almost every one has held a soiree or exhibition, which has been well attended, and which has been a source of great pleasure both to the members and their friends. The societies at Buffalo, Camden, Detroit, Chicago, New York, Rochester, West Chester, and other places, have done themselves great credit, and the cause of microscopy great good, by these exhibitions. Want of space prevents our giving a full report of these meetings, but we none the less accord to the managers the thanks of every intelligent microscopist.

Diatomacearum Species Typicæ.

DURING the past few weeks, we have been surprised to learn that many microscopists, otherwise intelligent, are ignorant of the fact that Prof. Hamilton L. Smith, of Hobart College, Geneva, N. Y., is publishing a series of slides, each containing a typical species of Diatom. These slides are issued in centuries, and of these centuries, six have been issued. The price has been fixed at $25 for each century, but to those who take the entire series even this moderate figure is reduced to $20. They are put up in exceedingly neat boxes or cabinets, containing 25 each, and the set of six hundred makes twenty-four boxes, which may be arranged in a book case like a set of books.

Prof Smith has long been known as an earnest student, of diatomaceæ, and is now acknowledged to stand at the head of living diatomists. His own collection of material is very large, and when to this be added the immense collection of the late De Brebisson, he was at once placed in possession of the means of issuing such a series of typical slides as was possible to no one else. With a liberality characteristic of the man, he offers these slides for less than one-third the cost of ordinary commercial slides.

Those of our readers who desire to possess this series, should address Prof. Smith directly.

Journal de Micrographie.

WE are glad to see that Dr. Pelletan's journal is rapidly recovering lost ground. The last issue is a specially interesting one. As many American microsccopists would no doubt like to take this journal, we would say that the subscription is $6 per year. Postal orders should be addressed to M. Maricotti, Administrateur, 3, rue Turgot, à Paris. Those who wish to do so may send their subscriptions to the office of the AMERICAN JOURNAL OF MICROSCOPY, and subscribers in France who find it more convenient to do so, may send their subscriptions to our journal to Dr. Pelletan.

Our Book Table.

Microscopist's Annual for 1879. No. 1. (Containing list of Microscopical Societies in the United States; Directory of all the Dealers and Manufacturers in the world; Tables, Rules, Formulæ, etc., useful to Microscopists. 12 mo., 25 cts. New York Industrial Publication Co.

Amongst the many useful departments of microscopic knowledge, which are not generally accessible, and which at the same time are so frequently needed, that most readers would prefer to have them in a hand-book, rather than scattered through the pages of a journal, the editor of this annual has found enough to make a small and, as he thinks, a very useful little volume. The range of contents is sufficiently shown in the title, and, as regards the execution we have but a few words of explanation to make.

Few persons have any idea of the difficulty of obtaining accurate statistical information of the kind contained in this book. We sent out circular after circular to the officers of the different societies, and from many of them we failed to elicit the slightest response, but *after* the book was issued, we had numerous complaints from these very societies in regard to the errors it contained. Foreseeing this, the editor took the precaution to add a query mark (?) to the statements made in regard to all societies from which no report had been *recently* received. This will at least enable the reader to distinguish the reports which are reliable from those which are in the slightest degree doubtful.

We believe that this is the only directory of manufacturers and dealers ever issued.

In regard to the other contents of the volume, it is hoped that they will be found generally useful and acceptable.

It is the intention of the editor to issue a yearly edition of this Annual. The directories will, of course, remain substantially the same, but all the other matter will be entirely new. At the low rate at which the book is offered—25 cents—it is to be hoped that it will be a welcome yearly visitor.

The Kansas City Review of Science and Industry: Edited by Theo. E. Carr, Kansas City, Mo. Monthly, $2.50 per year.

This able journal is now in its fourth volume, and has been steadily growing better and better since its beginning. It is the representative of Western scientific progress, and although the editor complains that as yet the *Review* has not met with that measure of encouragement which is necessary to render it self supporting, he need have no doubt of ultimate success if he keeps on. The journal deserves success, and it is only a question of time as to its securing it.

The journal covers a wide range in its columns, but the articles are almost always ably written, and the selections judicious. Our Western friends should see to it that this journal is not suffered to fail for lack of support.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

P. Angulatum.

Ed. Am. Jour. Microscopy—I am moved to speak in reference to communication of Nelly A. Romeo, in reference to the markings of *P. Angulatum*. It is more than two years since I first saw the appearances described by Miss (or is it Mrs.?) Romeo. My 1-6 with glycerine immersion, shows *Angulatum* studded with beautiful nearly hemispherical bosses, similar to, but larger, than those on *Surirella Gemma*. The appearance of hexagons is an optical delusion or illusion produced in part by imperfect definition. A similar illusion is produced by perfectly circular dots printed on paper, arranged in the same way as the bosses on angulatum.

A diagram illustrating this was published in the *Monthly Microscopical Journal* some years ago, and credited, if I remember correctly, to the French optician, Nachet. I regret I have not the volume at hand, that I might give the date, page and author with certainty. GEO. E. BLACKHAM.

Dunkirk, N. Y., June 30th, 1880.

P.S.—Will Miss (or Mrs.) Romeo oblige by giving combination of ocular, amplifier, length of tube, etc., with which she obtains 20,000 diameters with her 1-6.

Twenty Thousand Diameters.

Ed. Am. Jour. Microscopy—Won't your correspondent, Miss Romeo, give the microscopists of the country some information as to who made her 1-16 or 1-32 in. eye-piece, which she used on her 1-6, or else how long a draw-tube she used, in getting her magnification of 20,000 diameters? Where now is Prof. J. Edwards Smith, and Dr. Blackham, who have hitherto supposed that they were setting the people an example in the use of deep eye-pieces? Even Prof. Francis Gerry Fairfield must look to his laurels. FOUR INCH.

Parasites of the Housefly.

Ed. Am. Jour. Microscopy—I have lately in my microscopical researches found a number of minute worms in the *heads* of the common housefly. They resemble the eels found in vinegar. When the head is crushed between two glass slips, they are discovered swimming very lively in the blood expressed. What are they, parasites? I have seen no mention of them in books. Have any of the readers of the JOURNAL noticed them? In some flies I have found but one, others two or three.

ERNEST BARTRAM.

1513 Vine St., Phila., July 1st, 1880.

An Evening With Fasoldt's 1,000,000 Test Plate.

Ed. Am. Jour. Microscopy—Of course we scarcely hope to resolve the whole forty one bands of this magnificent plate, the product of a new machine constructed by Mr. Fasoldt expressly for the execution of fine ruling, and capable of dividing an inch into 10,000,000 parts. In order, however, to assure ourselves that the lines are really there, and cleanly cut, and only awaiting sufficient power to be fully resolved, we close the aperture in the diaphragm, put on a Spencer inch of 30°, place our lamp—which we prefer to daylight—7 or 8 inches from the centre of the stage, and about 3 inches above and the same behind its horizontal axis. Now with a thin card under the clips we so adjust the condenser that a narrow, very narrow, image of the flame's edge is projected upon the card directly across the field of view. For this purpose an ordinary double convex lens of 2 or 2·5 inches focus, is as good as most condensers, and a great deal better than some.

Having obtained a satisfactory pencil of light; we remove the card, substitute the rulings, and are rewarded for our painstaking, by a sight which is not given every one to see. The whole forty-one bands are in the field, with sparkling lines of brilliant spectra, occupying seven of the lower bands, the red rays being refracted by the 30,000 band, orange, yellow, green, blue and indigo, succeeding each other, upon each succeeding band (which is so very near the number of undulations per inch, for color as given by Herschel, that we are almost tempted to turn aside for a moment) to the 60,000 band, which shows a dark violet; and this color, inclining a little to gray, and broken only by the golden brown of the division lines, extends throughout the remaining bands to the 1,000,000, with a regularity which, considered as the result of human effort, is simply marvelous, but which taken in its optical connection, shows that the lines do exist in a perfect state: it being very evident that the least fault would cause a break in the sequence of color, we thus establish the most conspicuous feature in the entire plate. One glimpse exhibits this convincing fact with greater force than a whole volume of declarations.

After the million band, we find three additional bands called test bands, ruled in 50,000 lines to the inch with division lines between them; and all three presenting the brilliant green of the solar spectrum in strong contrast with the dark violet of the higher bands and the lively brown of the division lines.

We now exchange the inch objective for an eighth of 175°, same maker, immersed in water, with a little glycerine added, remove the diaphragm and condenser, lower the lamp to a trifle below the level of the stage, and move it a little in front, with the edge of the flame still towards the mirror, and pushing the mirror up to an obliquity of 175°, or more, if the construction will admit, project a thin, sharp, well-defined pencil of light through the bottom of the plate at right angles to the lines; which done, we may consider ourselves well on the way to success.

Naturally we are curious to examine the test bands before anything else, partly because they are a new invention, and partly because we hardly expect to see the lines they represent.

The lines in the first of these test bands, are cut of the same breadth and depth as those of the 26th or quarter million band, but as they are only 50,000 to the inch, instead of 250,000, we easily resolve them, and see exactly of what the 250,000 band is composed. We now move along over the division line between the first and second test bands. These division lines, cut very much broader and deeper than any other lines on the plate, are also a new feature introduced by Mr. Fasoldt, and serve, like milestones, to mark the space passed over, thus saving time and facilitating in many ways the operations of the observer.

The lines of the second test band are cut the same as those of the 34th or half a million band; and although possessing the same value as those of the first test band, they are very much finer, and by consequence not quite so easily found. We get them, however, with a beautiful fine black line at the bottom of the cut, and are now, if we have not been before, well satisfied of the existence of distinct, clean cut lines in the half million band. We now attack the third test band, which, like the others, has its lines the 50,000th of an inch apart, but of the same cut as the million band, and are only about one half as broad and deep as the last we examined, and a little patience and nice manipulation are required to bring them into focus. We see them at last, however, infinitesimal as they are, and render at once our word of praise to the genius who dared not only to project, but to execute, a test so many years in advance of microscopical science.

With all our adjustments undisturbed, we move the plate to the beginning, or 5,000 band, and are struck with the marked difference in the appearance of these lines as compared with those we have just examined, a difference which, thoroughly understood, goes far of itself to establish the possibility of ruling the million band. But we pass rapidly on to the 60,000 band, stopping only to admire the uniform regularity of the ruling, and the fine sharp, black lines at the bottom of the cut, resulting from a refinement of execution peculiar to work of this description.

The 70,000 demands greater care, and a little readjustment of focus or illumination, during which process we notice the beautiful pink color lying at the bottom of the division lines, which seems to indicate that good work is being done.

For the 80,000, we apply a Woodward prism, gaining by this means a greater obliquity of light, sufficient to show the 80,000 nicely, and gives us a glimpse of the 90,000, when considering that the eighth has accomplished all that can be expected from it, we relieve it from further duty, and another evening will take up the 1-16th, simply remarking that the results this evening have been obtained, with neither fuss nor paraphernalia, from resources ordinarily at hand.

F. S. BURRELL.

Albany, N. Y.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Buffalo Microscopical Club.—The Club met April 13th, 1880, at the rooms of Messrs. Slocum and Thornton, Main St. The paper for the evening was by Henry Mills, on "Fresh Water Sponges." It is printed in full in the June number of this journal, and is well worthy of perusal. Dr. W. C. Barrett read the *resume* of current microscopical literature which covered the ground thoroughly. Under personal work reports, Mr. Jas. W. Ward reported the destruction of slides prepared by the wax method, owing to the wax melting and obscuring and injuring the objects. This is an unusual occurrence, and Mr. Ward stated that the slides had not been subjected to undue temperature. President Kellicott, reported notes on the larval *anodontæ* and stated that he had lately found numbers of them on the tails and fins of minnows in his aquarium. In March last, he found numbers of the same bodies on young black bass. A note on the larval salamander mentioned the fact of the appearance of a pair of oblong organs on the under side of the anterior part of the body. The attention of the Club had been called to them two years ago. A note in the Encyclopædia Britannica, page 674, refers to a similar appendage on a larval *Triton*. Their use is problematic at present. President Kellicott, also referred to the so-called ("warts") found upon different species of fish. He had found them upon the sand pike, blue pike, yellow pike and perch of the vicinity of Buffalo.

May 11th.—A meeting of the Club was held at the rooms of Messrs. Slocum and Thornton, this date. President Kellicott in the chair. The Secretary, Mr. Fell, reported that the Common Council of the City of Buffalo, had passed a resolution April 4th, 1880, granting to the Club, the use of a room in the Central School Building. On motion of Dr. Barrett, this very becoming act of the Common Council was accepted, with the thanks of the Club, and it was decided to hold the next meeting, at the new quarters. The obtaining of permanent quarters in so acceptable a building as the Central School, coupled with the fact that the donation is from the highest authority, marks an era in the progress of the Club, and undoubtedly insures it a long lease of life. The fact of the microscopic societies throughout the country being wholly scientific, and therefore, in a broad sense, educational, in their work, should cause them to be more substantially recognized by the public authorities than they are. The Common Council of Buffalo, has established a precedent which other bodies of like authority would do well to copy.

President Kellicott, chairman of "Committee on Publications," reported in favor of the early issue of a publication of the work of the Club, and presented a plan whereby this much desired object might be attained.

Mr. Ward read an exhaustive and interesting report of the current microscopic literature, the subjects brought up being discussed *seriatim*.

The subject for the evening "Embryology" was then taken up, the President and Secretary reading extracts from a paper on comparative embryology, "The History of the Genoblasts and Theory of Sex," by Chas. Sedgwick Minot, which furnished principally the base of the subject for discussion during the evening. Prof. Kellicott, had prepared a number of drawings illustrating the subject. Dr. Howe exhibited embryos in different stages of development from man and hog, illustrating the similarity at this stage of life in the embryos of different animals.

Dr. W. C. Barrett exhibited a number of pathological specimens of his own preparation.

Mr. Fell exhibited an "Acme" stand with the new R. & J. Beck micro-spectroscope attached, also, slides from the placenta, and umbilical cord, prepared by himself. The R. & J. Beck micro-spectroscope differs from the Sorby Browning instrument, in that it is attached to the objective end of the microscope tube, instead of at the eye-piece end.

The propriety of the Club taking a "field day," in the near future, was discussed, after which the society adjourned.

The announcements for the next meeting of the Club, to be held June 8th, were as follows. A paper by Dr. Lee H. Smith, on "Diptheritic Degenerations of the Spinal Cord." A short paper by the Secretary, Mr. Geo. E. Fell, on the Spectroscope, more particularly relating to a description and use of the new micro-spectroscope of R. & J. Beck.

Resume of current literature, by Prof. H. Poole.

West Chester Microscopical Society.—Regular meeting June 2, 1880. The President, Dr. Jesse C. Green, called the meeting to order, when the Secretary, B. Harry Warren, read a report of the Society's visit to the Camden reception. The name of F. T. Davis, a clerk in the Recorder's office of Chester County, was added to the list of members. Oral communications being in order, Dr. J. T. Rothrock spoke at length in regard to the double-staining of bleached and unbleached specimens. He had recently been shown by Dr. Hunt, of Philadelphia, a specimen in which the protoplasm had been left in the cell wall with signs of its not having passed through alcohol. This manner of treatment of specimens with protoplasm in them is advantageous, being more simple and requiring less time for preparation. A few days since, the Doctor had procured a young shoot of the horse chestnut, and put a section of it in a mixture of iodine, etc. Afterwards he bleached it on tin, and in fourteen hours he succeeded in gaining what would have cost eight days of hard labor by the old method.

Under written communications, Alfred Sharples read a short answer to a question asked him on the street the other day, as to "What benefit he thought to derive from the Microscopical Society?" We are improving ourselves in the microscopical school of the heart, as well as the mind. We are all learners of the great works of Nature, and our belief is that the more a man studies the works of his own Master the more does he see his own deficiency and try to do right. It matters not what branch we pursue, we are always satisfied with the benefit we attain. There is no lack of material in our county to work on, therefore everybody should be up and doing, for the persons who have never studied can have no conception of the beautiful productions of nature. They cannot appreciate them. Yet, on the other hand, how proud is the discoverer of a new plant, etc. Such a person feels he has not lived in vain, but is useful as well as ornamental, and builds for himself a lasting foundation to a lasting monument. Our work is entirely a labor of love, and in its success we look for our pay.

Stephen P. Sharples, of Massachusetts, was noticed by the President among the audience, and was asked by the former to give the Society a short description of the microscopical organization in Boston, of which he is a member. Mr. Sharples said that their Society was really no more than a section of the Botanical Society of Boston, and met twice a month. There, he said, we are in possession of Prof. Bailey's West Point microscopical library, and what is still more valuable, his wonderful collection of diatoms.

A call for a short statement of the Society's late visit to Media, was presented to Dr. Jackson, who reported the West Chester Microscopical Society having been courteously met at the Media station, and escorted with their instruments to the Hall by the Media Association. The exhibits, especially the histological specimens shown by Dr. Stellwagen, created much interest. and the visiting parties seemed pleased withal. Fifty-eight instruments were in position, nine representing the West Chester Microscopical Society. Since its very foundation, in 1833, the Delaware County Institute of Science has ever been leading an active life, and bids good promise for the future.

President Green had been requested to extend the thanks of the Media people to their sister society, which were duly welcomed.

Dr. Rothrock thought no society could gain the height in science sought if they insist only on the display of bought slide specimens. I can't tell how this one thing has grated on me in the past. We should awaken a new train of ideas. Let us only take a grain of corn and place it under the microscope, or any unprepared objects. The appearance and change must be beautiful.

Stephen P. Sharples thought any source of water supply would make an interesting study. He had been working for nearly three years in the waters of Cambridge, Mass. If you will wet a fine sheeting (free of starch grains) with water, you will find a good yield of specimens, unless the water is very pure. I can generally find in Cambridge water from 16 to 20 diatoms, minute worms, etc. In it I see the changes which are taking place in water animalculæ and plants. I am now doubtful as to whether clathrocystis can be found at all in a pond in Boston; that it even spoilt the ice of three years ago. As the hot weather came on it gradually disappeared. Many changes of the infusoria are not in books, but close observation is what is here needed, and it is that which wonderfully interests.

Dr. Rothrock said our basin contained the green plant spoken of, and he did not think cleaning would hurt either the basin or the plant.

Mr. May, in the company of Dr. Wood, three years ago, visited most of the ponds of our neighborhood in search of the volvox globator, which is simply a green substance (but beautiful under the microscope). They at last found it in the West Chester basin, from which they had been drinking it daily. Flowers, also, are blooming around us in abundance, and their pollens, under the microscope lens, are always a sight to behold with interest. Another class is the seeds of plants which, with a two-inch power objective, are very beautiful. In fact, there is no end to the objects if men will only look for them. Lichens can be found on every old fence rail, and do not require mounting either to show to advantage. I should advise the following of some special line of study, for only in specialization can man in these days acquire eminence.

Mr. May's motion for the Society to adjourn until the first Thursday of September, was seconded by Capt. Cornwell, and unanimously agreed to.

Reading (Pa.) Society of Natural Sciences. Microscopical Section.—This Society was organized January, 1869. It is an incorporated body, with a membership of about fifty. Weekly meetings are held; and already the Society can boast of a large and well regulated cabinet, illustrating the various departments in natural history. The Microscopical Section is a recent acquisition, and is the life of the society. During last winter and spring, six Microscopical Soirees were given. To each entertainment, besides the regular members, there were specially invited, by printed card, such of our citizens as it was believed would be interested in the subject; and the result was large and enthusiastic audiences. The exhibitions were held in the large rooms of the Society in Library Hall, and between looking at the beautiful objects exhibited by the microscopists, and a glance at the large collection arranged on shelves and in cases, representing animate and inanimate nature in its various forms, the time passed speedily and profitably. The objects on exhibition were from the cabinets of Drs. M. A. Rhodes, Stanley Smith, J. B. Brooke, P. M. Ziegler, D. B. D. Beaver, and J. H. Raser; also, Professors D. B. Brunner, H. H. Hollenbusch and Capt. E. P. Boas. Last month the Section spent a day in the field, and succeeded in collecting numerous specimens which will be mounted in due time for next winter's exhibitions. It is contemplated to repeat these excursions into the country, during the summer, at intervals of about three or four weeks.

New York Microscopical Society.—Regular meeting March 19th, 1880. Minutes of last meeting were read and approved. Prof. E. H. Day was elected an active member. Donations announced by the Curator: From Mr. Hyatt, 25 slides; from the President, 12 slides; from Mr. Swasey, 14 slides—a detailed description of which is entered in the catalogue of the Curator. The Corresponding Secretary read two communications, one from Otto Brandt, Secretary of the Berlin Microscopical Society, containing, among other things, suggestions for exchanging material, the other from K. M. Cunningham, of Mobile, Ala., enclosing foraminifera.

The Curator was requested by the President to attend to the matter of exchanges in behalf of the Society.

The President reminded the members that the bi-monthly exhibition would take place on the 16th April next.

Dr. Deems exhibited an unnamed infusorian, and announced a paper thereon by himself next meeting.

On motion the meeting adjourned.

Regular meeting held April 2nd, 1880, the President in the Chair. The Curator announced as donations: Two slides from E. Mauler, Switzerland. Two slides from the President. Zeiss Catalogue of instruments from the President.

Dr. Deems read a paper on a parasite found by him on a fresh water snail, and illustrated the same by drawings.

Exhibited: By Mr. Braman, a vegetable fungus. By the President, two kinds of algæ, Batrachospermun moniliforme, and Tetraspora flocculus; also, Embryonic Snails. By Mr. Michels, of Section B, a spider changing his clothes, all parts duplicated. By Mr. Bogert, "Hook's Micrographia" a quarto 215 years old, very fully illustrated, showing the methods and results of microscopical investigation in 1666.

The bi-monthly exhibition of April 16th, 1880, consisted of a display, by the projecting microscope, of a series of slides of rocks and minerals, by Mr. A. A. Julien, of this Society. Mr. Julien accompanied the display by a lecture and diagrams which enabled the audience to understand the subject treated. The visitors numbered nearly two hundred.

WALTER H. MEAD, Rec. Secretary.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Pleurosigmas and many other diatoms, marine algæ, and much miscellaneous material, in exchange for good mounted objects; correspondence invited. M. R. Booth, Longmeadow, Mass.

Well-mounted slides of human pathological specimens, viz.: Sarcoma, carcinoma, fibroma, and epithelioma, several varieties of each, also lung in pneumonia, kidney in Bright's disease, for other well-mounted pathological or histological slides; send for list. Henry Froehling, 59 N. Charles Street, Baltimore, Md.

In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

Will exchange selected named diatoms for well-mounted histological. pathological, and anatomical preparations; state what you have and terms of exchange; my preparations all good. W. W. Riner, Greene, Iowa.

Wanted, in exchange for books on the microscope, Schimper's "Synopsis Muscorum Europæorum," and Berkeley's "Handbook of British Mosses." A. C. Stokes, Trenton, N. J.

To exchange for a microscope or accessories, a double barrelled breech-loading, laminated, steel barrel shot gun. F. O. Jacobs, Newark, O.

Exquisite wild seeds, neatly mounted, in sets, by genera and species. Also pollens in balsam, arranged in same way. Rev. J. T. Brownell, Lyons, N. Y.

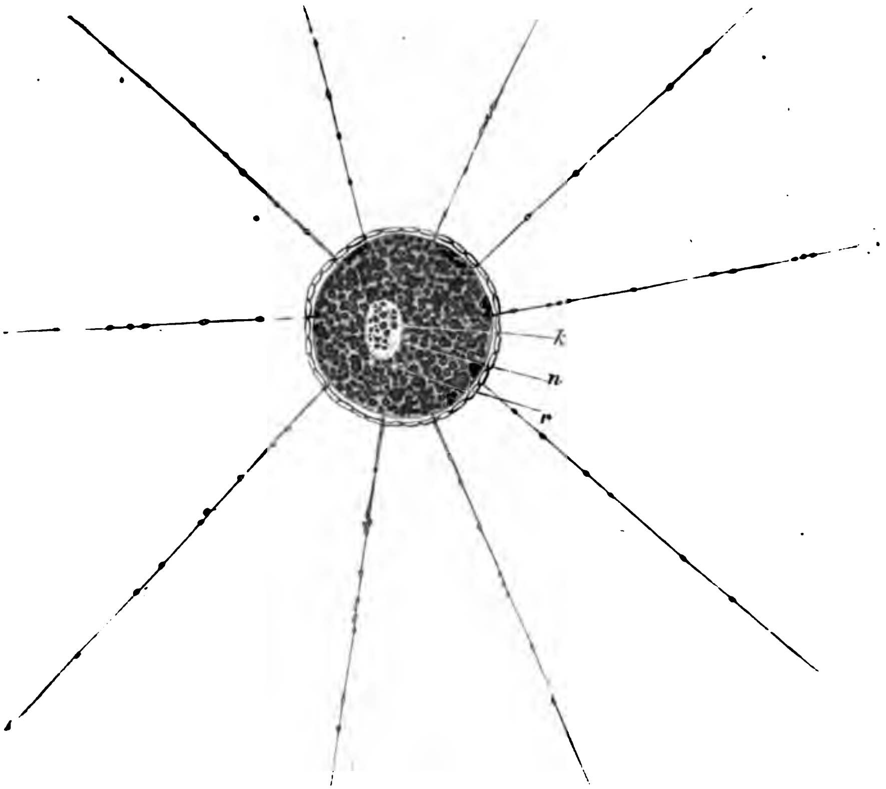

Fig. 2. *Pinacocystis rubicunda.*

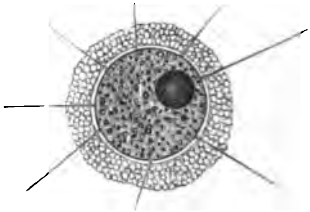

Fig. 4. *Hyalolampe exigua.*

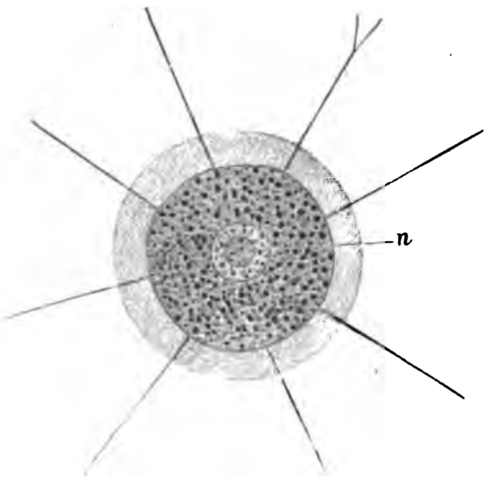

Fig. 5.

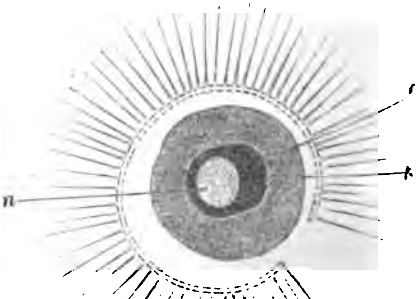

Fig. 3. *Acanthocystis spinifera.*

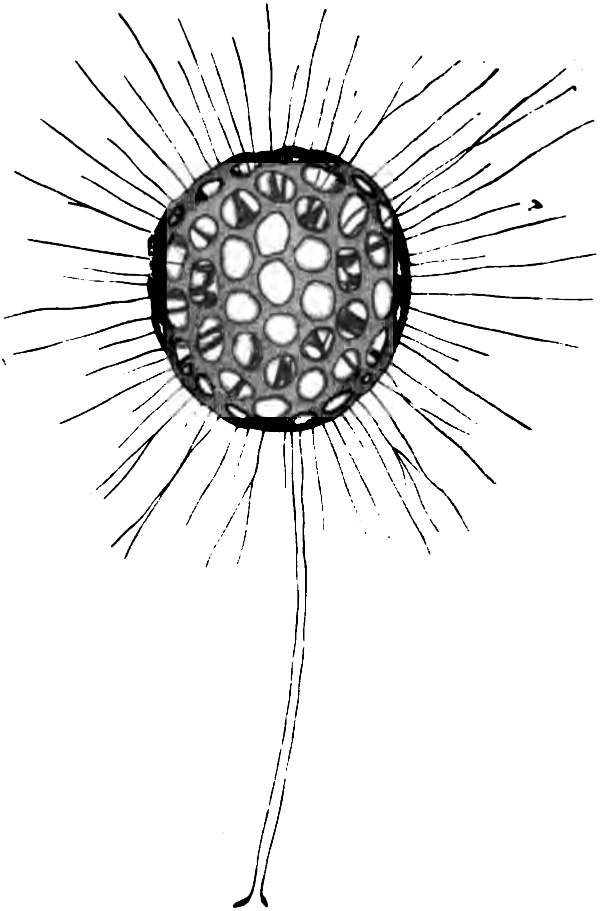

Fig. 1. (*After Greef.*)

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Pelomyxa Palustris and Other Rhizopoda, with Remarks on Definition.

(Continued from page 156.)

LITERATURE.

(1) On Force. By P. G. Tait, in Recent Advances in Physical Science. 1876.
(2) Biologische Studien. Heft I. E. Hæckel.
(3) Das Protistenseich. E. Hæckel, 1878.
(4) Ueber Rhizopoden. R. Hertwig and E. Lesser in Archiv f. Mik. Anat. Bd. X.
(5) Ueber Radiolarien d. Sussen Wassers. R. Greef, in Arch. f. Mik. Anat. Bd. V.
(6) Ueber Clathrulina. L. Cienkowski, in Archiv. f. Mik. Anat. Bd. III.
(7) Logic. Alexander Bain. 1874.
(8) The Principles of Science. W. S. Jevons. 1874.
(9) A System of Logic. J. S. Mill.
(10) Ueber die Einzelligkeit der Amœben. L. Auerbach in Zeit. f. Wiss. Zool. Bd. VII.
(11) Die Einfachsten Lebensformen. B. Eyferth. 1878.
(12) Forms of Animal Life. Geo. Rolleston. 1870.
(13) Practical Biology. Huxley and Martin. 1877.

AND now we come to a difficulty: *Biological terms are, many of them, incapable of definition.*

How widespread is this evil it would be impossible for me to estimate. In the very minute department of the Fresh-water Rhizopoda, there are many terms which are either absolutely undefinable, or so nearly so that only a master, perfectly conversant with all the facts, is able to define them, and then such definition is not adhered to. Protoplasm, nucleus, contractile vacuole, pseudopodium, (which comprise nearly all the terms used in describing naked rhizopoda), and many species of the genus amœba, are cases in point.

These things ought not to be. In fact, I go so far as to say that no scientist has a right to use a connotative name the connotation of which he cannot state. *In other words, every class name must be defined.*

Most of you, my readers, no doubt assent to this. Probably not one of you will live up to it.

Biology seems never to have comprehended the fact that under no circumstances must she make use of a name that has no clear meaning. Even the more exact sciences forget it now and then. This is sufficiently proved by the fact that Prof. Tait thought it necessary to say to the "British Association," "There can be but few people in this country who have an accurate knowledge of the proper scientific meaning of the little word Force!" But, in Biology the case is much worse. The very best men of the day seem to think it perfectly proper to say that there is no distinction between plants and animals, i.e., that neither of these terms can be defined, while they continue to use them just as though every one were familar with their meaning. Such words ought not to be employed, so long as they have no definite meaning.

There are many names which, though definable, are the names of *so great a variety of objects* that their meaning is apt to become shadowy. *All such names ought to be kept free from vagueness by frequent definition.*

It is usually very difficult to define such words, and for that reason it is seldom done. Such negligence is the great cause of that gradual loss of meaning which we have to lament of many scientific terms. Let a, b, c, ... z, represent a series of forms in which there are a certain number of points of agreement between a and b. Represent this number by x. Then between a and c are x — 1 points of agreement; between a and d x — 2, etc., until we arrive at z, between which and a, there exists no similarity, save such as is too general to be noticed in the particular series.

Nevertheless, negligence has caused both a and z to be called by the same name, because of the close similarity existing between any two *successive* terms of the series; and the name, at first definable because only applied to the first few terms, has become meaningless with the discovery of the last terms. Had the rule of "frequent definition" been adhered to, we would have had a series of definitions corresponding to the progress of discovery, and z would have been excluded from the series, even though it had to go without a name for a time.

Perhaps I ought to apologize for this digression from the consideration of "*living mud*" into the realm of pure logic. My excuse is that in these studies clearness is of more than usual importance. These forms lie at the very bottom of the scale, being but a slight advance upon the Monera of which Hæckel says, "They may be considered as the first beginnings of any given living organic race," (2). "For the deeper understanding of our doctrine of evolution, and of the thereupon founded Monistic philosophy, there can be but few branches of science of such fundamental significance as the natural history of the lowest forms of life," (3). This is the opening sentence in one of Hæckel's most charming productions. But what if this science be made unscientific by careless use of those most subtile instruments, words? The whole fabric of modern thought must suffer thereby somewhat of injury.

At any rate, if I shall have helped any one to clearness of thought, the digression will not have been useless.

To return—The word membrane is not easily defined. I do not remember ever to have seen a definition of it, save one by Von Mohl, which I have forgotten, although at the time I was struck by its clearness and universal applicability.

Whatever else a membrane may be, it is certainly a solid, and, therefore, must always have a clearly defined double contour when seen in optical section. The common idea is that one dimension of this solid must be far smaller than the others, i.e., That the thickness must be much less than length or breadth. (I use the term solid not so much with reference to the consistency of the material as in opposition to surfaces and lines. It is the thickness that we usually see in the study of microscopic membranes and it is the double contour of *this dimension* that is always referred to by writers in discussing the presence or absence of a membrane). This error is not surprising since the most frequent and therefore best examples have, without exception, this peculiarity. (It will be remembered that I do not propose to give a general definition of membrane, but merely one suited to the needs of Protobiology). As a rule, microscopic membranes are extremely thin, but if all else should remain unchanged, no one could refuse to give the name to ever so thick a structure.

Another common error consists in supposing that a membrane must be a *closed* sack. This is from the same source, and is sufficiently refuted by Monothalamia. These Rhizopoda, many of them, secrete a shell which is as truly a membrane as any structure in Nature. It is true that this shell is seldom or never called a membrane, but that there is no good reason for this, is shown by the following quotations from the classical work of Hertwig and Lesser (4). Speaking of the shell of Pseudochlamys Patella, a form very similar to the common Arcella, they write: "More careful observation teaches that an uncommonly thin membrane closes the opening of the shell, all except a hole which allows of the exit of pseudopodia."

This "membrane," is the precise equivalent of the lower surface of "shell" in Arcella. To be sure, no structure can be discerned in it, but this is also the case with respect to the thinner parts of the "shell" of Pseudochlamys. In short, there is every reason for thinking that this "membrane" is as much a part of the "shell" as is the "lower surface" in Arcella, since it differs in no way from it, save in thickness: but "The thickness of shell decreases continually as we go from centre to circumference," (4) and this is natural on the theory that the "membrane" is simply a continuation of the "shell." That Hertwig and Lesser regard the former as a true "membrane" is evident from the fact that they so call it in five different places. That they do not so consider the "lower surface" of Arcella is evident, because they never so speak of it, but always as a part of "shell;" whereas, they never so speak of the "lower surface" of Pseudochlamys but make a sharp distinction between it and "shell." The truth is that the "membrane" is as much "shell" as is the convex upper surface of Pseudochlamys, both upper and lower surfaces being true membranes and constituting together the shell. In Arcella, however, no portion of shell is a membrane, if we have in mind the whole thickness of shell, but, as was first shown by Hertwig and Lesser, the shell consists of two membranes placed parallel and joined together by membranes perpendicular to these, so arranged as to give to the surface an appearance of hexagonal structure.

Perhaps the best example I could give of a membrane in form of a sac, with single opening, is Lecythium hyalinum.

The shell of this Monothalamian is ovoid in shape, hyaline and structureless. Another fresh-water rhizopod has a shell which differs in no essential way from that of L. hyalinum, save in having an opening at *each* end. (Diplophrys Archeri, 4.) Each of these shells is a membrane.

Another fresh-water rhizopod, Clathrulina elegans, a most important Heliozoan, for description of which see (4, 5, and 6), has a shell of silica, nearly spherical, and *penetrated by numerous openings* which give exit to the fine and long pseudopodia.

Fig. 1 shows this shell, in a rough way, upon its long thin stalk, or peduncle, and the pseudopodia radiating from the body within, which is not figured.

"Cienkowski describes and figures the shell of Clathrulina, as composed of numerour polygonal plates, which each enclose an opening. This is, however, not the case, but the sphere consists, as Greef correctly figures it, of a single piece," (4). The shell is therefore a membrane, since it differs from that of Diplophrys in no essential particular, save in having a greater number of openings.

We come now to shells which, like the last, have numerous openings, but which are composed of numerous plates or pieces. It is obvious that these pieces may be held together so as to form a protective covering varying in rigidity, and in the group of Heliozoa, we find examples of almost every sort, from most loosely arranged spicules to the firm capsule. Pinacocystis rubicunda, a marine Heliozoan, discovered by Hertwig and Lesser, has a shell ("Skelet") "which consists of a number of separate little plates ("Tafelchen") which are so arranged as to form a tightly closed capsule" (4). "The pseudopodia protrude through openings left between the plates" (4). Each plate is solid, but they are so united as to leave a minute hole between any three plates. I infer this not from the description of P. rubicunda, as given by Hertwig and Lesser, but from these words: "Evidently, Pinacocystis is the less developed ancestral form ("Vorstufe," literally preceding step,) of the Acanthocystids, and is as nearly related to Acanthocystis spinifera, as this to A. turfacea," (4). The shell of A. spinifera consists of "little plates," very similar to those of Pinacocystis, and joined together in the same manner. From the centre of each plate there proceeds a long fine spine or thorn, and this may be said to constitute the only noteworthy difference between the two shells. A. turfacea has the same sort of shell, but the spines are of two kinds. In each case the "little plates" have a nearly circular contour when viewed superficially, and the ordinary double contour when seen as always figured in section. Of course only one thing can occur when such plates are placed edge to edge—minute openings will be left, of a triangular shape, each bounded by three disks. So far as I know, no one has ever called these structures "membranes," but in my opinion, each plate of Pinacocystis is a true membrane, and so with the thorny plates of the Acanthocystids. The only noteworthy difference between these shells and that of Clathrulina, is that the membrane of latter *is* the shell, while the former are *composed of* membranes; as a result of this difference the membrane of Clathrulina seems to protect more perfectly the protoplasm which secreted it than does any one plate of Pinacocystis. This, however, is only a matter of more or less, and examples might readily be found, in which the protection afforded by true membranes is very slight, though not, of course, so imperfect as would be given by a single plate of Pinacocystis.

But, does it make any difference whether we adopt the terminology which obliges us to say "*This* shell is a membrane, *that* an aggregate of membranes," or one which compels us to say, "This membrane is continuous, that discontinuous, an aggregate of many and various parts." This last we would have to say should we call the whole shell of such forms as Pinacocystis a membrane. There would then be no halting place, when once you admit that a membrane may be discontinuous. It might be most "fearfully and wonderfully made," a complex structure requiring months of study for its comprehension, and yet be a "membrane." We might then very soon get so far from those simple objects with which we started that the word would cease to have any important meaning. How much better if we say at once that no object which is composed of pieces shall be called a membrane! It is true that a *continuous* object may have a somewhat complex form just as some unicellular plants may be more complex than some multicellular, but there is a limit in the one case, in the other none.

Each plate then of Pinacocystis is a membrane, nor is it any objection to say that the protection given by any one plate is insignificant; for in many cases of true membranes the protection is very imperfect. Moreover, there are Heliozoa in which the protective covering consists of minute rods or needles homologous with the plates of P., but which have no definite arrangement, not even being in contact with each other. Evidently, we ought not to call the sum total of these needles a "membrane," but there is every reason for so calling any individual needle.

The method of definition, according to Bain, is as follows: "Assemble for comparison, the particulars coming under the notion to be defined. By the particulars are meant not every individual instance, but *representative* instances sufficient to embrace the extreme varieties." "To define a species of plants the botanist collects recognized examples of the species, including the widest extremes admitted into it. He compares the several specimens, noting their agreements, until he finds what characters prevade the whole: these he expresses in suitable language, which language is henceforth the definition of the species. So in dealing with the higher groupings, he follows the same obvious plan." "We must be led in the first instance by the popular denotation of the name, yet, if we abide by that, we fail to obtain any important community of meaning. It is in such a perplexity that the golden rule must be called to our aid: we must take some means to form a class upon a deep and wide agreement. If need be, we must depart from the *received denotation*, leaving out some instances and taking in others, until we form a class really possessing important class attributes," (7). This method somewhat modified, I believe to be correct.

Bain has a theory of the nature of definition which is not accepted by either Mill or Jevons, but with this we are not concerned, as I have already given the true theory according to these writers. But he has also, I think, fallen into error in the treatment of the *method* of definition, though not to any very important degree.

Induction and definition are not so unlike as we are apt to suppose; in fact they are, to a certain extent, identical, and the method of the one must also be that of the other. Jevons has shown (8), I think, that the only method of Induction is that which consists in making and testing hypotheses; this, also, will be found to be the only method of definition. We must assemble for comparison *a few* "representative instances" from the consideration of which we obtain a definition which is hypothetical, and must remain so until perfect knowledge shall demonstrate its fitness.

The "representative instances" I have already given, and will now give that definition of membrane which seems to follow from their comparison, and afterward *test* its fitness by such cases as occur to me, so far as space will allow. A membrane, in Protobiology, is any solid that has these attributes: (1) It must be continuous, not composed of parts or separate pieces; (2) it must be a product of the action of Protoplasm; (3) it must serve to protect the protoplasm which secreted it from too close contact with its environment. Anything having these three attributes is a membrane; anything not having them is a non-membrane. It is, therefore, evident, that in defining any positive term we also define its negative, and I am unable to understand how it is that Bain should think it necessary to "Assemble for comparison the particulars of the opposed notion,"(7).

Returning now to the shell of Pinacocystis, let us inquire of what use is it to apply the term membrane to each one of the "little plates" composing it. A glance at Fig. 2 will show that the shell, as a whole, has more apparent resemblance to an ordinary membrane than has a single plate; but granting the propriety of the definition given, it may be said that such structures are included among membranes more because of necessity than for the sake of any benefit to be derived therefrom. If this were so, then this shell ought, by a modified definition, to be excluded from the list; for among many evils that are prevalent in Biology, there is, perhaps, none greater than that of giving a thing a useless name. But we must, in any complete description of this shell affirm of each plate that it has the three attributes given in the above definition of membrane. How much shorter to say of the plates "They are membranes!" We have found, then, another argument for "frequent definition;" for so only can we secure *brevity* without vagueness.

Let us now proceed to test the definition by a few remarkable forms. So far as concerns the Ciliata, Flagellata, Acinetina, Fungi, and Algæ, it is evident that no fault can be found with it; in the last group, however, the cell wall is very often found to be made up of several membranes. The best test cases that I know of are to be found among the Rhizopoda. I need not describe the Heliozoan represented in Fig. 3, inasmuch as I have already given enough for the purpose in hand. The figure represents A. spinifera after treatment with strong acetic acid. Here, as in Pinacocystis, we are disposed at first to call the shell *as a whole*, a membrane, which is beset at regular intervals with long spines. In fact, the true structure of this shell "first becomes clear when some body passes through it: two or more of the basal plates are then seen to rise up as lids, leaving a path free for the passage of the body,"(4).

Of course no fault can be found with the definition on account of its including these plates, each of which is provided with a spine; for it is extremely common for a membrane to be more or less thickened at particular points, thus giving rise to peculiar markings: (On this point see Sachs' Botany) these spines are simply extreme cases of this common fact, but are peculiar in this respect that to each membrane there is but one protuberance.

The next test departs still more widely from the common form. Fig. 4 represents a most singular Heliozoan, the shell of which "consists of several layers of loosely united separable spheres of silica," (4). By what means these spheres are held together is still doubtful; perhaps by a jelly like substance secreted by the rhizopod. In this case Fig. 5 would represent an ancestral form; for here we have a protective covering, which is simply a thick layer of jelly-like matter.

I scarcely think it necessary to spend more time upon this definition; no doubt you are tired of it. I will say, however, that reading and observation have not acquainted me with a single case tending to break down the definition given. It is now obvious that a membrane may be of any form and of any consistency so long as it is not fluid. It is also evident that the definition must hold good as regards the cells composing the bodies of the higher animals and plants, since these cells are each the morphological equivalent of any unicellular organism, and since in them there is no such variety of covering as we find in Protobiology.

Not many years ago it was quite commonly thought that every Amœba was enclosed within a membrane: according to Auerbach (10) "Every Amœba is completely surrounded by a perfectly closed membrane which is structureless, very extensible and elastic, and is not easily dissolved by acetic or sulphuric acid, nor by alkalies." The strongest proof of this that Auerbach could offer was his A. bilimbosa. One of the most instructive chapters in the history of microscopic organisms might be written of this form and its relatives, but it would scarcely be in place here, since whether or no Hertwig and Lesser be right in their supposition that it is identical with their Cochliopodium pellucidum (which is a true Monothalamian), this form, which has retained its place in literature since the time of Auerbach, is most certainly no Amœba. And yet Eyferth, in the latest systematic work upon the freshwater forms of microscopic life (11), gives this as a "good species" of Amœba. No wonder that Hertwig and Lesser should propose to banish from systematic Biology the name Amœba, when a form so evidently superior in the possession of a very characteristic membrane, is called by the generic name which ought only to be given to the lowest nucleated organisms.

There is, however, no great difficulty in defining Amœba satisfactorily. Even the rough definition I have just given would probably be found good enough for most purposes, and I am unable to see what ground there can be for dropping the name. What is wanted is simply a definition.

But what proof of his position can Auerbach offer as regards the true Amœbæ, in which for the most part no sign of a limiting membrane can be detected?

The following description of the action of dilute alkalies upon A. radiosa is his strongest point. "Immediately everything within becomes dissolved with the exception of a small amount of finely granular matter and some foreign bodies, while, on the other hand, a structureless membrane remains behind which now represents a closed sac. By diffusion this sac becomes distended, so as to form a spherical bladder, which after a time bursts at some point and through the rent the contents emerge, leaving behind an empty wrinkled sac, showing numerous folds," (10). Many similar facts have been long known, and so far as I know have been disputed by no one. Nevertheless, the best authorities now deny the existence of this membrane, which Auerbach thought he had discovered, and in fact I know of no prominent name that could be mentioned in support of any sort of "membrane" theory. The mode of taking food particles into the interior, which particles in some cases are nearly as large as the Amœba itself, is a fact which alone seems sufficient to disprove the presence of any membrane.

"It does not seem possible to demonstrate the presence of an external enveloping membrane in the Amœbina, except in A. bilimbosa, unless reagents be employed, *which themselves probably cause the differentiation observable after their use,*" (12).

In this sentence Rolleston gives expression to an opinion which, though quite common, is probably incorrect. A far more correct one is well stated by Huxley (13), "all that can be said is that the *external layer is of a somewhat different constitution from the rest,* so that it acquires a certain appearance of distinctness when it is acted upon by such reagents as acetic acid."

The truth in this matter is easily found, I think, if we allow that what is true of Pelomyxa palustris is also true of other Amœboid organisms which show in optical section a similar limitary line; since in P. palustris the thickness of this line is so considerable as to make its investigation comparatively easy.

In many cases the so-called membrane is nothing more than the ectosarc, which, being of very slight thickness and sharply defined interiorly, has all the optical characters of a membrane. Examples are found among the more minute Amœbæ, some species of which look like thin walled sacs, enclosing a clear fluid in which float the nucleus contractile vacuole and a few granules.

W. G. Lapham.

(To be continued.)

Preparing Sponges.*

In a paper on the sponges dredged by the Rev. A. M. Norman, on the coast of Norway, Mr. Sollas makes the following remarks, which are of general interest:—"In preparing specimens for microscopical examination, I followed the ordinary methods for obtaining the spicules in the free state; but in cutting and mounting 'sections,' I adopted the processes which have hitherto, in this country at least, been confined to the examination of quite soft tissues. A piece was cut from the sponge large enough to contain a representative of each of its different tissues; this was then soaked in distilled water till its contained alcohol was as nearly as possible all extracted; it was then transferred to a strong solution of gum, in which it was allowed to stand for an hour or so; finally it was placed in the well of a freezing microtome, and frozen in the usual way. From the frozen specimen, slices could be cut of any required thinness, the razor, strange to say, passing through the soft tissues and hard spicules with apparently equal ease.

The slices so obtained were variously treated; some stained and some not, were mounted in glycerine of various degrees of strength; others were treated first with absolute alcohol, then with carbolic acid and turpentine and mounted in Canada balsam. 'Teasing' was resorted to in the case of some tissues with success, especially when it was found desirable to observe the behavior of the tissue with reagents. Altogether the various methods pursued have, I believe, succeeded in eliciting nearly all the information that could be extracted from the specimens; and that this is very far from being so complete as could be wished is to a great extent owing to the imperfect manner in which histological characters are exhibited in sponges which have been preserved in spirits without any previous treatment. Mr. Norman's specimens are perfect as spirit specimens; they were not preserved with a view to submitting them to detailed histological examination. And here it may be worth while suggesting that if in the future it should be desired to preserve sponges with this object, a preliminary soaking in osmic acid solution of ·02 or ·03 per cent. should be given to them before placing them in spirits; this will effect nearly everything that may be desired. With osmic-acid-treated specimens and the help of a freezing microtome, no difficulty should be experienced in obtaining an almost complete knowledge of the minute structure of any sponge."

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* "Ann. and Mag. Nat. Hist.," vol. v. (1880) p. 130.

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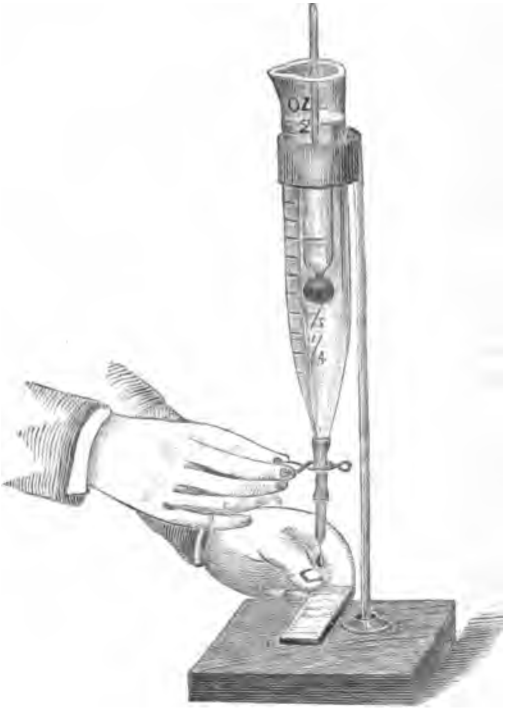
Improved Glass for the Collection and Examination of Deposits.



THE removal of urinary deposits by means of a pipette is an awkward and unsatisfactory mode of procedure, and several ingenious contrivances have therefore been devised to facilitate their collection and removal. Small glass trays with glass handles have been recommended; the tray is placed at the bottom of the urine-glass, and when the urine has deposited the tray is raised by means of the handle, and the sediment examined. In this way, however, the deposit is removed *en masse*, and successive layers cannot conveniently be examined *seriatim*. To obviate this, urine-glasses with glass or vulcanite stop-cocks at the bottom to draw off the sediment have been made; but the fittings are apt to get out of order by encrustation with phosphates unless considerable care is expended in keeping them clean. Messrs. Krohne & Sesemann have, however, on Dr. Ralfe's suggestion, contrived an exceedingly simple form of urine-glass, by which minute quantities of sediment can be withdrawn for the purpose of microscopic examination. The arrangement consists of a slight modification of Mohr's burette; this is shortened and widened, forming a conical cylinder of sufficient capacity to hold two ounces of urine, and width to allow a urinometer to float freely. The sediment is drawn off by means of a glass jet inserted into a piece of india-rubber tubing, which is attached to the neck of the urine-glass. The flow is broken by a spring pinch-cock, which, by compressing the tubing between the neck of the urine-glass and the jet, effectually prevents leakage. On pressing the pinch-cock the compression is removable, and a flow occurs. Three or four pieces of india-rubber tubing fitted with glass jets are supplied with each instrument, and these when not in use are to be kept in a bottle filled with dilute hydrochloric acid, to prevent their becoming encrusted. The whole instrument, mounted on a black stand with lacquered brass supports, is a neat as well as useful adjunct to the consulting-room table.—*London Lancet.*

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Failure of the Wax Cell.

PROF. H. L. SMITH, is generally acknowledged to be the first who proposed the well-known "wax cell," and this journal was amongst the first to give a description of it. In an article recently contributed to *Science,* Prof. Smith thus announces the failure of this device:

I believe that I was the first one to suggest the use of the sheet wax for the bottoms of cells for foraminifera and other opaque objects, and of wax rings for diatoms and other transparent objects.

The number of spoiled specimens, especially of diatoms and delicate transparent objects, which I can now show, proves that this method of mounting is decidedly bad. I have lived to see the day when I shall be quite glad if the responsibility of suggesting such a nuisance as the wax ring can be transferred to some one else. For large opaque objects like most of the foraminifera, seeds, pollens, etc., the object itself is not so much injured, but the covering glass will, sooner or later, become covered (inside the cell), on the under surface, with a dew like deposit, which, when illuminated, will glisten almost like so many minute points of quicksilver, and though out of focus when the object is viewed, will show very disagreeably, like a thin gauze between; and with transparent objects these minute globules will not only dot the entire field, as so many dark or light points, but the object itself will appear as though it had been wetted.

Not long ago a well-known optician showed to me a spoiled slide "podura." The scales were very good and large—in fact, it was a slide which I had given to him, and it had been selected by myself in Beck's establishment in London as unexceptionably fine. This slide began slowly to show spmptoms of "sweating." One scale after another appeared as though moisture had, in some mysterious way, penetrated to the objects; it was not water, however, for when the cover, after much trouble, had been removed, and warmed sufficiently to evaporate anything like water, the scales still exhibited the same appearance, and, in fact, the heat required to get rid of this apparent moisture was so great, that the scales were charred. When wax rings are used, this apparent wetting or "sweating" occurs quickly, and more disagreeable than this, innumerable elongated specks, possibly crystalline, appear all over the under surface of the cover-glass. The same trouble occurs when any of the ordinary asphalt preparations are used, and the only cement which I have thus far found to be tolerably successful is shell-lac thoroughly incorporated with the finest carbon (diamond black) such as is used in the preparation of the best printing inks; the solvent being alcohol, these rings dry rapidly, and the cover is attached by heating. Even these rings cannot be trusted, unless thoroughly dry, and spontaneous drying is better than baking. I have had preparations spoiled after mounting on asphalt rings, which had been made for over a year, and which had been subjected for several hours to the heat of a steam bath. With large, somewhat coarse objects, the defect is not so marked, but with delicate ones, and especially test objects, it is simply a nuisance. With care I think the shell-lac rings may answer pretty well. I have not tried the aniline colored rings. The moisture (whatever it is), and the crystalline specks, appear to be derived from the vaporizable parts of the wax, or cement, given off under conditions where one would suppose such a thing impossible; it is however a fact; I have the proof of it, and I dare say hundreds of others have, too plainly evident.

* * *

Highest Magnifying Powers.

BY ALLEN Y. MOORE.

It is well known to all practical microscopists, that the magnifying power of an objective may be increased by eyepiecing to a certain extent with a continued gain in resolving power. When the limit of resolving power is reached, the magnifying power may be further increased, but nothing is gained except in the apparent size of details already shown. After this, comes a period in which the magnifying power may be increased—almost indefinitely—but it is now very noticeable that the resolving power is impaired. The aberrations of the objective interfere greatly with the image. In fact, it is here that a lens is frequently said to "break down."

These three stages may be conveniently studied in an ordinary cheap 1-4 of 100°. With an amplification of 300 diameters, such a lens should easily resolve *Pleurosigma angulatum*, but try as best we can, the lines of *Surirella gemma* will fail to be seen. Now, if a higher eye-piece be applied—giving a power of 500 diameters—this diatom may be resolved. Supposing this to indicate the limit of resolvability of the object; a still higher eye-piece may be used; but the resolution is simply shown larger. This period probably will extend to 1000 diameters, but if increased much beyond this, less is seen at each increase of power.

The extent to which these three stages may be carried, is, of course, dependent upon the quality of the objective and its angular aperture. In testing objectives the magnifying power should be carried to the second stage, for a lens is frequently defeated, simply because the visual angles subtended by the lines (or dots) are insufficient for recognition by the eye.

In a recent article in the American Journal of Microscopy, a magnifying power of 100,000 diameters is mentioned, obtained by means of a Wales' 1-15. From the fact that *P. angulatum* was the extent of its resolving power, it is seen that the lens was far into the third stage of its magnifying power. Any such increase of power is, so far as practical work is concerned, useless; but the second stage is what we need and want. Frequently details are seen, but are so small as to tire the eyes, while if enlarged by a higher eye-piece fatigue is prevented.

Now, an interesting question, to me at least, is, What is the highest power ever obtained and used *without* losing resolving power? And what objectives are best suited to yield such powers? Will a 1-25 or 1-50 (or higher), with lower eyepiecing, give better results than a 1-6 or 1-10 with high eye-pieces and the magnifying powers the same?

I am not in possession of a 1-25 or 1-50 objective, and cannot make the comparisons I would like, but I will state the results obtained by my 1-6 of "180°" (or 100° "balsam angle,") and if others will do likewise, we may learn something of value.

I have a pretty full line of eye-pieces, from 2 in. to 1-50, the latter being of my own construction, and so far as my information extends, the highest eye-piece yet made or used by anyone. To those who have advocated only the use of the "A" (2 in. I suppose), this statement may seem like some of Prof. F. G. Fairfield's accounts; but this admits of proof and the sub-stage is not concerned. Now the next question is, will the objective stand this eye-piece, and not lose its resolving power? Yes! It stands it; but I do not wish to convey the idea that it is *easy* to use. Of course sunlight has to be used to see anything at all. Another question is, what will the 1-6 show under such an eye-piece? and which gives a magnifying power of *thirty two thousand five hundred diameters.* Well I have seen the last three diatoms of my balsam Möller Platte clearly resolved. The lines of No. 20 did not look exactly like "the pickets on a fence," but more like a lean horse's ribs. I may add that by lamplight and 1-2 in. eye-piece this diatom is easily resolved—although there was a time when I could not see how to coax it to show *S. gemma.* The dots of *P. angulatum,* under this high power show with a peculiar apple-green tint on light claret-colored ground.

I find that such high power is an excellent test for the stability of the microscope, inferior workmanship being shown by the vibration of the image in the field.

Let this question be decided by actual experiment. Will those who have such high power objectives please report?

Coldwater, Mich., July. 7, 1880.

How to Use the Microscope—New Edition.

THE new edition of this work is advancing towards completion, and will soon be ready. The book will be considerably enlarged, but the price will not be increased.

In reviewing the material which we had collected for this new edition, we found it utterly impossible to incorporate it in a work on the microscope at the low price at which this book has been offered. We, therefore, resolved to retain for this work its original character, "for beginners" and we shall immediately set about the preparation of a book about twice the size intended, for advanced students.

Microscopy in England.

MANY of us have an idea that showing the lines on Amphipleura at microscopical soirees is a peculiarly American "institution," especially since some of our microscopists have been twitted about it, and called "microscopical showmen" by English writers. The following extract from a lettter by a "Fellow of the Royal Microscopical Society" to the *English Mechanic,* will, therefore, interest some of our readers:

Dr. Blackham states that a "good many things that take place in England seem to us 'queer' here. Among them the selection of 'Angulatum,' to exhibit the powers of a 1-16 or 1-25." I do not perceive anything "queer" in the *selection* of Angulatum to exhibit the powers of a 1-16 or 1-25. The exhibition of the power is in the *quality* of the image. We know well enough that the Angulatum can be shown with a good ½ in.; but we believe it can be shown much better with a 1-16. For a tour de force in microscopy, I refer to this journal, vol. xxvi, p. 264, where Mr. Adolph Schulze details the fact that with Ross' ⅛ in. of 80° aperture he has resolved with reflected sunlight, *A. pellucida,* on Möller's balsamed test-plate. This latter result obtained with the greatest ease, * * * * Some of the finest specimens of *A. pellucida,* both dry and in balsam, are shown in England by lamplight, with ¼ immersions by Powell & Lealand. I may also assure Dr. Blackham that crossed striæ on *A. pellucida* (dry on cover) are well shown in England by means of Prof. H. L. Smith's Vertical Illuminator and any of our best immersion objectives.

Curious Errors of Vision.

DR. BLACKHAM'S reference to Nachet's optical illusion has brought us quite a number of inquiries in regard to it, and as very many of our readers have never seen it we here reproduce it.

Looking at the figure from a distance of twelve to eighteen inches, the dots appear to be hexagonal, and even though we know that they are circular, we cannot get rid of the hexagonal appearance. But if we examine them closely and singly, we at once see that the true form is circular. A good way to examine them for the purpose of finding their real shape, is to use a two-inch magnifier.

This curious effect is generally called an *illusion*, but it scarcely deserves that name. An illusion is usually regarded as something mental, while the deceptive appearances produced by this and other figures are really physiological, as has been very clearly shown by Helmholtz. The same is true in regard to another figure, which gives rise to a curious fallacy of vision. In Fig. 2 we have two horizontal lines crossed by diagonal ones, and the question is: Are these horizontal lines straight or crooked? As ordinarily examined at the distance of distinct vision, these horizontal lines appear to be decidedly crooked—bending towards each other at the middle. But if the reader will hold the page horizontally, and look *along* the lines, instead of *at* them, he will find that they are perfectly straight. So, too, when tested by a delicate straight-edge, they will be found to be as straight as a graver can cut them.

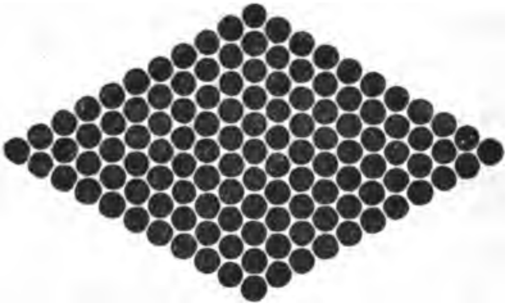

Fig. 1.—NACHET'S OPTICAL ILLUSION.

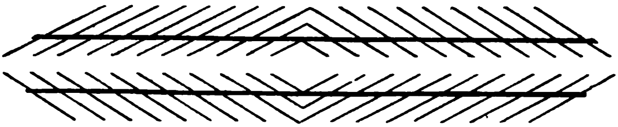

Fig. 2.—STRAIGHT OR CROOKED?

A study of these and similar figures, which might be multiplied indefinitely, will teach us that "things are not always what they seem," and will lead us to be cautious about pronouncing an opinion in regard to the *shape* of any object until we have carefully examined the *visual* conditions relating to it, as well as the optical qualities of our apparatus.

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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

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Vol. IV.

WE have now supplied the missing numbers of Vol. IV., of the AMERICAN JOURNAL OF MICROSCOPY, and can supply volumes bound uniformly, with those previously issued, for $1.50 each.

Since the beginning of 1879, we have electrotyped the pages of the JOURNAL, so that back numbers can always be supplied. Vols. I, II, and III were not electrotyped, and consequently some of the numbers of these volumes cannot be replaced.

The Meeting at Detroit.

FROM all that we can learn, the meeting at Detroit, on August 17, and following days, will be the largest and most important gathering of microscopical workers that has ever been brought together in this country. The retiring President is Prof. R. H. Ward, of Troy; the President elect, is Prof. H. L. Smith, of Geneva, and all the various committees are headed by well known and able men. Special arrangements for transportation will no doubt be made. Mr. Reynolds, of D. & M. Junction, Detroit, will, no doubt, be glad to furnish further information.

We are glad to see that the proceedings of the first two meetings have been published, and may be obtained from the Treasurer, Mr. George E. Fell, of Buffalo, N. Y. The price has been fixed at fifty cents to members, and seventy-five cents to non-members.

Medical Postal Micro-Cabinet Club.

WE have received a large list of subscribers to this club, and will send a circular to each in the course of a few weeks.

All that we propose to do in the matter is to bring together such gentlemen as we know are interested and qualified. We will place before them a plan of operation, and then they will elect their own officers and manage the society themselves.

Our part will be confined to the preliminary work of bringing the members together, and all the expenses of advertising, printing circulars, etc., will be borne by this journal, so that the society will not be called upon to foot any bills for work which it has not authorized itself. We feel that such a society would do more good than any other microscopical work that can be undertaken, and we are only too glad to lend it all the assistance in our power.

The Griffith Premium.

OUR readers will remember that at the meeting of the American Society of Microscopists, at Buffalo, Mr. E. H. Griffith offered a medal as a premium for the best specimens illustrating some common adulteration. We learn from the *American Naturalist*, that Mr. Griffith now proposes to substitute for the medal, with the consent of the winner, the superb half-inch objective, now made by the Bausch & Lomb Optical Company. This objective has an angle of nearly 100°, and with it, we have easily resolved the P. angulatum in balsam. Nor did it require any extra appliances to achieve this feat. The stand was a cheap affair worth about $10, and the concave mirror alone was employed to throw the light on the object.

Dr. Blackham's Paper on Angular Aperture.

THIS valuable paper is now ready for distribution and has been sent to all whose names are recorded in our books. If any have been overlooked they will please notify us.

It is but justice to the publishers to say that the issue of this book was not undertaken with a money making object in view, and the price was fixed at the low sum of 75 cents, so as to give every student of microscopy an opportunity to procure a copy at a rate which could be made remunerative only by a large subscription list. Having given such an opportunity to all, the price is now advanced to $1.25, and as the work will be bought only by specialists it is not for sale by the trade.

The American Association for the Advancement of Science.

THIS Association meets at Boston, August 25th—the week following the meeting at Detroit. As previously announced, the chairman of the Microscopical Section, Prof. Lattimore, of Rochester, N. Y., has made elaborate preparations to ensure the success of this session, and it will pay those who can do so, to visit Boston at that time. There is ample opportunity for those who feel so inclined to visit both meetings.

The First Microscopical Society in the Country.

IN the "Microscopists' Annual" it is stated that the Boston Society of Natural History is the oldest microscopical society in the country, and we believe it is the oldest now in existence. We are informed by Dr. Frey, of Bellevue Hospital, that the first club of microscopists of which he has any knowledge, was one of which Dr. Alonzo Clark, Dr. Gilman and some others, were at the head. This society, or club, was formed about forty years ago. We should be glad to hear of any earlier association of microscopists.

Our Book Table.

An Elementary Text-Book of Botany. Translated from the German of Dr. K. Prantl, Professor of Botany in the Royal Academy of Forestry, Aschaffenburg, Bavaria. The translation revised by S. H. Vines, M A., D.Sc., F.L.S. Fellow and Lecturer of Christ's College, Cambridge. With 275 Illustrations. 8vo. Extra cloth. $2.25.

The translator tells us in his preface that this book was written by Prof. Prantl, to meet a growing demand for a work on Botany, which, while less voluminous than the well known "Lehrbuch," of Prof. Sachs, should resemble it in its mode of treatment of the subject, and should serve as an introduction to it.

As a systematic work on botany, that is to say, as an aid to the ordinary work of "botanizing" as it is called, this book will be found quite meagre, but for the far higher and more valuable study of the anatomy and physiology of plants, it is quite full and very thoroughly illustrated. The young microscopist who employs his time in making vegetable preparations will find it a very efficient guide in the study of the different parts.

Wood's Library of Standard Medical Authors for 1880.

We have received the following works in this series:

VENEREAL DISEASES. By E. L. Keyes, A.M., M.D., Adjunct Professor of Surgery in Bellevue Hospital Medical College, etc.

A TREATISE ON FOREIGN BODIES IN SURGICAL PRACTICE. By Alfred Poulet, M.D., Adjunct Surgeon Major, Inspector of the School for Military Medicine at Val-de-Grace. Translated from the French. Two volumes.

A HANDBOOK OF PHYSICAL DIAGNOSIS, COMPRISING THE THROAT, THORAX AND ABDOMEN. By Dr. Paul Guttman, Privat Docent in Medicine, University of Berlin. Translated from the Third German Edition, by Alexander Napier, M.D., Fel. Fac. Physicians and Surgeons, Glasgow. With colored plates and numerous illustrations.

TREATISE ON THERAPEUTICS. Translated by Dr. D. F. Lincoln, M.D., from the French of A. Trousseau and H. Pidoux. Ninth edition. Revised and enlarged with the assistance of Prof. Constantine Paul.

THE SURGERY, SURGICAL PATHOLOGY AND SURGICAL ANATOMY OF THE FEMALE PELVIC ORGANS, in a series of plates taken from nature, with commentaries, Notes and Cases. By Henry Savage, M.D., Lond. Third edition. Revised and greatly enlarged. Thirty-two Plates and Twenty-two wood engravings.

Such is a sample of the works which will be issued monthly by Messrs. Wm. Wood & Co., during the year 1880, to subscribers to their Medical Library. The rate is so low ($15.00 per year for a monthly volume,) that it is a marvel how they can afford to give even the commonest works at these prices, and when we consider that one work alone, (the last on the above list,) has been sold heretofore for nearly as much as the year's subscription, and that all the works in the Library are recent, and by authors of the highest reputation, the wonder is increased still more. Messrs. Wood & Co. know, however, that the book buyers amongst the physicians, are the young, enterprising men whose purses are as yet light; they have sought to serve the interests of this class, and we feel sure that they will not lose their reward. Physicians who wish to add really valuable works to their libraries never had such an opportunity as is here presented.

Science: A Weekly Record of Scientific Progress. Illustrated. 229 Broadway, New York. $4.00 per year.

This is a new periodical recently started by Prof. Michels, whose name is familiar to most of the readers of this journal. It is the intention of the editor that *Science* shall occupy the same position in this country that *Nature* does in England, and if able and earnest co-workers will enable him to achieve such a result, the prospect for success is very good. He has already obtained assurances of support from many of our best scientific men. We wish him all the success which such an enterprise deserves.

Proceedings of the National Microscopical Congress, and of the American Society of Microscopists.

The proceedings of these two meetings have now been issued in a neat volume of 77 pages, with several lithographic plates illustrating the papers read. The volume will prove valuable not only as a record of the proceedings of the society, but on account of the valuable papers which it contains. Amongst others, we find the valuable paper on Objectives, by Dr. Blackham, together with its accompanying table. The pamphlet does credit to the committee, who have evidently labored under considerable difficulties in getting it out. Its publication at this time, just before the meeting of the society, cannot fail to advance the interests of the body whose labors it represents. We could have wished, however, that the committee had placed some price on it, so that those who are not now members, might obtain copies and thus be induced to join. These Annual Proceedings, if properly managed, may be made a powerful agency on behalf of the society. But the publication must not be an *after thought.* Proper provision must be made for securing complete and accurate reports, and for publishing them promptly, and these arrangements should be made *before* the work of the Detroit meeting commences.

The Rainbow.

It is but a short time since we noticed this bright and most useful little monthly, and now we learn with great regret that its publication is suspended. The idea on which *The Rainbow* was based was most admirable, and it was quite unique. The editor, Prof. Logan, of Turtle Creek, Pa., is obliged to give it up as its success was not commensurate with the amount of labor required. The volume which has been issued is a monument to his tact and ability in catering to the literary requirements of young people.

Verification of Thermometers for Medical Purposes.

ALTHOUGH this subject is not immediately connected with microscopy, yet, as we have a great many physicians on our subscription lists we introduce it here, the matter being one of immense importance from a humanitarian point of view. It is, therefore, with great pleasure, that we quote the following from the circular of the Winchester Observatory of Yale College :

The observatory desires to encourage the general verification of thermometers on the part of the members of the medical profession, meteorological observers, and all those persons who have occasion to note temperatures to less than one degree Fahrenheit. The inaccuracies of the thermometers in use by the majority of such persons are considerably greater than is commonly supposed.

It will be seen that the observatory places every facility at the disposition of observers and thermometer makers for the ready verification of thermometers; and there is no good reason why a purchaser should not have an accurate knowledge of the errors of his instrument should he so desire.

The observatory will make arrangements with hospitals and other institutions using a number of thermometers, for the systematic examination at stated intervals of all thermometers in their use. Such an arrangement precludes errors arising from the use of newly made instruments which have been verified, but whose scales have not yet attained an approximately permanent position.

For the present the comparisons of clinical and meteorological thermometers will be made with a water bath in which the water is brought to a given temperature and mechanically agitated before the comparison is made. The standard to which the primary and secondary mercurial standards will be referred is the air thermometer.

Ordinary thermometers are returned within three days from the time of their reception, if the observatory charges for verification are remitted with the thermometers.

Our readers who desire further particulars, should address Leonard Waldo, Box 853, New Haven, Conn.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Honor Claimed Without Service Rendered.

Ed. Am. Jour. Microscopy—I was much surprised to read in the June number of your JOURNAL, certain claims therein set forth by Mr. F. H. Wenham, in his reply to Mr. Stodder's letter on page 96, April number of the AMERICAN JOURNAL OF MICROSCOPY.

I have been a silent reader of what has been written upon that now settled question of Angular Aperture, and could not be induced at this late day, to say anything upon the subject, if it were not for a spontaneous feeling of indignation which possessed me, at the unjust claims and insinuations contained in Mr. Wenham's last letter. It is not an unnatural feeling of resentment for any microscopist, who feels the proper gratitude towards those opticians who have furnished us such valuable objectives, as we can now obtain to aid us in our studies; a feeling that one who has presented nothing in the last twelve years, but opposition to the great step forward, viz: The idea and constructon of the modern high angle, "duplex front," and "homogeneous" immersion objectives, has no right at this "eleventh hour," to step in and ground an unjust claim for the honors due *those* who have "borne the heat and burden of the day;" as well as the unfairness which has characterized the dealings of said claimant, with all objectives furnished for his examination by one, who at the sacrifice of health and rest, has done more hard study and practical labor, to furnish the microscopist objectives capable of demonstrating to the world the proof of the theory, that *immersion* objectives can be made having an interior angle, and admitting rays to pass through and form an image, at the eye-piece, at an incident angle greater than 82° when passed through an object in balsam.

And Mr. Wenham must learn that American microscopists (at least) have a more improved method, than the ancient one for rewarding true laborers for services rendered; and further, although to no one will they yield their appreciation of all he himself has successfully done, for the optical world; yet in justice to Mr. Tolles, whose efforts in our interests we equally appreciate, we cannot willingly remain silent, and permit Mr. Wenham to apparently willfully, and without just grounds, accuse Mr. Tolles of stealing his ideas published a "quarter of a century ago." As to what reply Mr. Tolles or Mr. Stodder, either or both, will make to Mr. Wenham's last letter, is a matter that does not personally concern me. I desire simply to call the attention of microscopists somewhat familiar with the subject, to some important portions of Mr. Wenham's paper in the *Quart. Jour of Mic. Science* for 1855, and especially to some of his own later references to it; and leave them, not Mr. Wenham, shrouded in his thick cloak of egotism, to decide whether or no he has sufficient grounds in his *unsuccessful* attempts, for his claims as well as hints, that from his fertile brain and hand have emanated—and still radiate a crown of diadems about his brow—all the best ideas and improvements of modern microscopists and opticians.

In the *Quarterly Jour. of Mic. Science*, 1855, page 302, as a sequel to a long discussion by Mr. Wenham with J. D. Sollitt, to prove "that balsam does diminish the angle of aperture of the the microscopic object-glass," when in action for viewing a structure mounted in that medium. And having learned in the course of that controversy how sharply some test objects were exhibited under this reduced angle, Mr. Wenham published some *attempts* made by him as he says, "for the purpose of *viewing* objects, with the *full aperture* of the object-glass, when mounted in Canada balsam." These *attempts* were as follows, in his own words (Italics mine.)

"I first took a small hemispherical lens of about 1-90th of an inch radius, and *cemented it over* a selected specimen of one of the Diatomaceæ. (N. Sigma) with Canada balsam." By this means of *mounting* the object, for it cannot be considered anything else; and I will show, by a quotation from Mr. Wenham's own writing further on, that he did not at that time, nor 19 years later, consider it anything but a device for mounting the object, so that light would pass from the object radially through the hemisphere without undergoing any refraction.

He then assumes, that, "the consequence of which is, that the *full* and *undiminished* aperture of the object-glass is made to bear upon the object." Also, that these divergent rays, as delineated in his drawing, "may be considered to represent the aperture of the object-glass."

Of what object-glass, or what angle, Mr. Wenham then said nothing. So that the reader would legitimately presume, he could use any object-glass, and get the "*full* and *undiminished*" aperture. As Mr. Wenham had claimed about that time, to have made objectives of various angles, to almost 180°, we are astounded to see how his device would excell the best efforts of Mr. Tolles; who, even now, has not made an objective having over 145° "balsam angle," taken in a medium of 1·50 index; and that only in an experimental lens.

But in 1879 and 1880 Mr. Wenham comes to the rescue, and says, he used a "dry 1-5 of 104° aperture; and would have us understand, it was "*I*" who *first* viewed an object with rays at 104° angle, from a balsam mount. Or, to use his own words, "got 104° on the object within the slide." What difference does it make, will he please inform me, what angle he got "*on the object?*" That is not the point at all in controversy. But "*to get through the object-glass*," image forming rays at an angle greater than 82°, through a balsam object, which every microscopist understands, (at least, before reading Mr. Wenham's 1855 paper,) is impossible with a dry objective, and Mr. Wenham has emphatically challenged "anyone to do so with an immersion lens." So that it seems hardly possible that he would now have us believe, that he, in 1855, using his device, illuminated his object and viewed it with the microscope, with the "*full* and *undiminished*" angle of his object-glass 104°. But such we are forced to infer from his paper, is the idea he intended to convey. He knows very well that no light through that object could reach his eye at that angle, *with his device as then delineated;* but only at 82°. And, if not, what right has he to claim that his arrangement was "the same as the formula since claimed by Mr. Tolles, in his 'duplex front' system."

No candid, unprejudiced person, familiar with the subject, can, in my opinion, compare the drawing of Wenham in 1855, and imagine any ordinary dry 1-5 objective used above it, with the "duplex front" objective as illustrated in the *Jour. Royal Mic. Soc.*, 1878, page 143; and pronounce them the "same formula."

In order to fulfill my promise to show by Mr. Wenham's own words, that he considered his device only a method of mounting the object, and further, to show that as late as 1874 he considered it a useless addition to aid a 1-5 object-glass such as he used, I will quote from an article by him in the *M. M. Jour.*, vol. xi, page 118, written expressly for the purpose of criticising one of Tolles' "duplex front" 1-6 objectives. I purposely emphasize certain expressions of his, to call special attention to them, and I will make the quotation liberal that I may not be accused of "mutilation."

After Mr. Wenham had, as he claimed, found the 1-6 had only 68° balsam angle at *closed point*, instead of 98°, as stated by its maker, he continues: "I will now briefly refer to the plan whereby I first obtained the *full* dry aperture on an object immersed in balsam." * * * * "The combination *was not* strictly an *immersion* object-glass, for the hemisphere might be said rather *to belong to the object*, and as *part of it*, forming together a dry element *with a structure in its centre.*"

"The experiments with an additional hemispherical lens *set over the objects*, were tried by me many years ago for the purpose of ascertaining its *practical* value for the exclusive investigation of balsam mounted objects requiring large aperture *(as an ad-*

dition for improving a properly corrected dry lens it is useless.") . . . . . Say a dry 1-5 of 104°. . . . . . "The same lens with the object in the centre of radius would serve for any object-glass in which there was sufficient distance before the front lens to introduce it."

"Eighths and upwards of large aperture come so near, that it is scarcely possible *to make any use of it*, as an extra adaptation, *mounted in another setting in front*." Same as he describes in his last letter, AMERICAN JOURNAL OF MICROSCOPY, June, 1880. page 137. "Finding the effect but *little superior* to that produced by higher powers in the ordinary way, I did not trouble the makers about adopting the plan, which I should have done, *had it proved of sufficient utility*. I was then aware of the optical conditions involved, and did not *abandon* it without due experiment."

Now, when Mr. Tolles *independently* conceived the *true* idea, and made it by his masterly skill a successful practical fact, Mr. Wenham, although stating as above that his 1855 device as conceived and constructed by him was "*useless*," and no part of the objective, has the effrontery to come forward in 1879 and 1880, and claim that it is "the same" as Mr. Tolles' "duplex front," and insinuates that he stole the idea from him; notwithstanding the fact, that he *abandoned* his idea as of little or no value. While Mr. Tolles' first conception and construction has become, as shown by his work, a grand success for *all objectives* from a 1-5 upwards.

To such a claim as Mr. Wenham now makes, I can only reply, "consistency, thou art a jewel." To successfully base a claim such as Mr. Wenham now sets up, it becomes evident he should not have written anything since his 1855 paper, or be blessed with a better memory.

He seems to have forgotten that in 1856, in a reply to Prof. Baily, *Quart. Jour. Mic. Science*, page 87, about viewing an object mounted in balsam with large angle objectives; he said, "I have no hesitation in offering that any object mounted in the usual manner in this medium, has *never* been seen with an angle greater than 85°; but in all probability the extreme limit has been about 78°."

To disprove his statement, he believed it would become necessary to deny "the first laws of refraction, upon which my assertion is based."

I would ask Mr. Wenham if the same "first laws of refraction," would not render it absolutely impossible for him, with the *unusual* method of mounting the object as illustrated and described in his 1855 paper, to see his object ("*N. Sigma*") with the "*full* aperture" of his 1-5 object-glass, 104°? Was it not "about 78°?" If so, are we not justified in the opinion held by the majority of microscopists about Mr. Wenham's views upon the aperture question as set forth in quotations by Mr. Stodder in the AMERICAN JOURNAL OF MICROSCOPY, April, 1880? Mr. Tolles to obtain and use, rays at an angle outside of 82°, whether with a *three system* objective, like the one so unjustly dealt with by Mr. Wenham, (which with Prof. Abbe's Apertometer has "93° + balsam angle,") or a "duplex front," presupposes a hemisphere or its equivalent *below* the object, which method subjects him to another insinuation of theft, namely, the object within a sphere, which brings us to something really amusing in that would-be famous paper of 1855. Mr. Wenham *attempted* to make little hemispheres with small fragments of hard Canada balsam placed on a diatom on the slide, and warming them until they run into a somewhat hemispherical form.

When the *object thus mounted* was viewed same as the first case of the lens, let us see what he says of the result, using his own language *verbatim*.

"The luminosity of the field of view around the balsam object is many shades darker than in the uncovered portion of the slide, which appearance is caused by the *diminished angle, or cone of rays, of the illuminating* pencil."

"From this fact it is evident, that the *theoretical* perfection of *mounting objects* in this manner would be to enclose them exactly in the centre of a minute sphere of balsam." "But I must confess that I *have not* been *successful* in effecting this."

Yet, in the face of his acknowledged failure, he comes forward and insinuates that twenty years afterwards Mr. Tolles stole the idea from his paper.

As Mr. Tolles had never seen his paper of 1855, it is just to presume that when he conceived the idea of the sphere and carried it into *successful practical* operation, so that we are to-day reaping the benefits of this great improvement, it was his own independent idea. And to him, I, for one, am willing to accord due praise, as well as in the language of Prof. Abbe, *Journal Royal Microscopical Society*, 1880, page 30, "to highly appreciate his merits, in the propagation of sound ideas about the aperture subject."

Please observe that Mr. Wenham informs us in viewing the objects mounted as he describes, that, the angle of the illuminating cone of rays was "diminished."

Yes, in fact it was "diminished" to 82°.

Yet he would have us understand and believe that the emergent cone which transmitted the image of the object through the hemispherical lens and microscope to his eye, was a cone having an angle *equal to the "full aperture"* of his dry 1-5 object-glass, 104°, which is sufficient in my opinion to demonstrate that his claim is purely imaginary, in so far as his drawing shows that his device "mounted in a setting to slip over the front of the object-glass," transformed that 1-5 into a "duplex front objective," the same as would be constructed by Mr. Tolles, admitting light at an angle of 104° through an ordinary balsam mounted object. In conclusion, this is no more than we might expect from one who has seen fit to lay claim to the honor of first inventing "homogeneous" immersion objectives, (*Jour. Royal Microscopical Society*, 1879, page 394, also AMERICAN JOURNAL OF MICROSCOPY, 1880, page 137,) when all other opticians are willing to accord that honor to those to whom it rightly belongs, viz., John Ware Stephenson and Prof. Abbe.

Although we might long ago have had "homogeneous" immersion objectives, by an American optician, had Mr. Tolles' earnest experiments with oils led him to some medium having an index of 1·525 and proper *dispersive* power. As he did not have access to the same ample laboratory as Prof. Abbe, he is not disposed to rush into print and advance a claim of priority because he once experimented in that direction.

And now, Mr. Editor, after intruding so much upon your space, I will leave the subject in the minds of microscopists, to accord "honor to whom honor is due," for *first* practically advancing *correct* ideas of the "sphere" and "duplex front" objective. For is a man who *fails* to practically carry out his idea, and "*abandons*" it as "*useless*," any more entitled to credit, when another man *independently* conceives a *similar* idea, and appreciating its real merit, puts it into successful practical use, than if he had *never* had the idea? A. A. BRAGDON.

Bangor, Maine. July 16th, 1880.

Mr. Stodder in Reply to Mr. Wenham.

Ed. Am. Jour. Microscopy—If any one thinks that Mr. Wenham has made any reply (in this journal for June,) to my paper in the April number, I only ask them to compare, item by item, Mr. W.'s paper in the *Journal of the Royal Micros. Society*, for December, 1879, with mine in April, and Mr. W.'s in June, and note how many of my points he has been unable to refute. I have no personal controversy with Mr. W. and have made no personal attack on him. Mr. W.'s published writings are as legitimately subject to criticism, as those of any other man. Mr. W. has seen fit to publish certain theories on angular aperture, and made certain statements in regard to certain objectives made by Mr. Tolles that I know to be wrong. It would seem to be proper to state the truth about both for the benefit of the public. If correcting the errors, misquotations, and misstatements of a noted writer and "teacher" of the art of making objectives is not a contribution of information to users of objectives, it will be hard to say what it is.

Mr. W. seems irritated by my use of the term "wretched adaptation," forgetting that it is only a quotation from himself *courteously* applied by him to Tolles' semi-cylinder. He little thought when he invented that phrase that it would return to plague the inventor.

The only other thing in the April paper that Mr. W. has been able to object to is his adaptation of 1855, which he says is "the same formula since obtained by Mr. Tolles." Does Mr. Wenham undertake to tell the world that the extra front lens is the whole formula of Tolles' objectives? I called attention to the fact that Mr. Wenham had never stated the balsam angle that he then obtained though the angle possible has been the very subject of the discussion for the last eight years. Now, after twenty-five years rest, he claims to have obtained 104°, and appeals to the diagram then published. The diagram is drawn 108°, but no reason is given in the text for drawing that special angle. The diagram might, for *aught that appears in the paper*, have been drawn 120°. The thing important is, Would or did all the rays so drawn go through the rest of the lenses to form an image of the object; or, in the words of Mr. Wenham, were they "image-forming rays?"

I will only add to refute Mr. W.'s inference that Mr. T. copied, imitated, or derived any ideas from Mr. W., that Mr. T. never read or saw Mr. W.'s paper of 1855 until this present month of July, 1880.

CHARLES STODDER.

On Penetration.

Ed. Am. Jour. Microscopy—After reading the admirable paper of my friend, Dr. Blackham, in the July number, just received, I feel impelled to add to the remarks of Dr. Rider, to which Dr. Blackham refers, a few words in behalf of the much contemned "penetrating objectives."

Dr. Carpenter's definition of penetration is correct, and describes that quality of an objective which Dr. Blackham claims, or did claim, to be "a positive defect in any objective." Indeed, his language in the paper referred to might justify the inference that he regards it as a defect in the human eye, which must be tolerated, but is to be regretted, though I do not think this is his real meaning.

I partly agree with Dr. Blackham and his followers, but my views may be stated thus: Penetration is antagonistic to *perfect* definition, and, therefore, penetration is an objectionable quality in objectives whose purpose is definition solely; but mere definition is not the sole purpose of objectives, and in those objectives whose purpose is comprehensive view, penetration is a virtue as well as is flatness of field.

Fortunately for microscopists, penetration cannot be got rid of by the opticians, except at the expense of the field of view, and Dr. B.'s beloved 1 inch objective still retains some of it, while it has gained much over the narrow angles in definition, and in this respect his objective approaches somewhat to the capabilities of that wonderful optical instrument, the human eye, which has *both* penetration and definition in a very great degree, in consequence of its inimitable "compensating adjustment," so well described by the doctor.

In some objectives this faculty of penetration is very striking. I remember distinctly with what surprise I saw, long ago, under a 1 inch of first class English make, a stained specimen of utricularia. At one view were seen the top layer of cells, the spiral vessel occupying the middle of the stem, and the bottom layer of cells, and all these with so much distinctness, that while the threads of the spiral vessel were in actual focus, the cells above and below were so nearly in focus that there was no dimness to their outline, and without changing the focus, the size, shape, depth and arrangement of the cells of the stem could be clearly seen, and the structure and central position of the spiral vessel perfectly seen. I am not ashamed to say that to this day I long to possess that objective, which, according to Dr. Blackham, is so faulty.

For the mere definition of surface, Dr. Blackham's perfect objective, without penetration, would of course excel, but how much of the total of microscopical work is of that character? And in regard to histological work, what amount of such work has been done over with wide angled objectives, and any improvement on the original effected? I ask this for information, in view of the repeated *implication* that most or all histological work so far done, is imperfect and erroneous. Surely no wilder error was ever made by the old histologists than has been promulgated by some of the late "wide angled histologists."

I wish to say, too, that Dr. Blackham's figures of the wire netting are quite fallacious as they show on paper, which is, of course, different from what they show in the field. As the figures are given, they show exactly what a non-penetrating objective would show, viz: all the lines equally defined; but with a penetrating objective, in Fig. 8, one set of lines would be a little clearer than the other, and although there would be a *slightly* poorer definition of the set of lines in focus, there would be sufficient definition of both sets, and not the slightest difficulty in seeing what was the relative position of the two layers. Having first ascertained the relation of structure, *then* comes the opportunity for the doctor's perfect, non-penetrating, surface defining objective to get in its best work.

On page 160, Dr. B. tells us with evident satisfaction how his 1-6 objective shows P. angulatum "studded with beautiful nearly hemispherical bosses." That is another defective objective: if it had *no penetration* it would show the bosses simply as so many well defined rings, varying in size according to the part of the boss that was in focus.

C. M. VORCE.

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Reflection from the Inside of the Body-Tube of the Microscope.

Ed. Am. Jour. Microscopy—Your reprint on page 156, of an article from the *Journal of the Royal Microscopical Society*, upon the subject indicated above, ought to call the attention of every young microscopist in the country, it seems to me, to the condition of his instrument. I am well satisfied that this trouble is the unsuspected cause of the failure of many good objectives to show a really sharp and clear image, when any eye-piece higher than the two inch is dropped into the tube. I also believe that it is the foundation in many instances of the opinion we so often hear expressed, that the A, or two inch, eye-piece will show anything within the power of a specified objective, as well or better than by the use of a higher power eye-piece.

The remedy proposed by Dr. Groves, and also suggested in Phin's "How to Use the Microscope," page 84—that of collars for the draw-tube and eye-piece to slide through—is effective. Where the microscope has a "full length" body, the draw-tube, except occasionally in micrometry, will not be used, probably, to any great extent, and the liability of the formation of a reflecting surface at the lower end of the body-tube is not as great as the upper end of the draw-tube. At that point, however, it certainly will occur unless measures are taken to obviate the friction. Messrs Sidle & Poalk, of Philadelphia, as I understand, intend to apply a simple and ingenious device to the draw-tube of the new large stand which they are about to bring out, to prevent the formation of a reflecting surface below the eye-piece. It is to turn an annular groove on the inner surface of the draw-tube near the top, of such a width that the surface which is exposed to the friction of the eye-piece will not be uncovered, no matter what eye-piece may be used.

This device might be applied to any stand at comparatively slight expense, whereas the application of a collar would necessitate either a new and larger body-tube or else a narrower eye-piece. A. L. WOODWARD.

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A Reply to Dr. Blackham and "Four Inch."

Ed. Am. Jour. Microscopy—It seems that my statement of having used a magnifying power of 20,000 diameters, has excited some interest, and I hasten to reply to the letters published in this journal of last month, as well as to those I have received from other sources concerning the same matter.

I find that the general opinion is that I made use of an amplifier and very long draw-tube. This, however, is wrong. I used the 1-6 objective as before stated, on my large stand, with draw-tube *closed*, and obtained my high power *by the eye-piece.* The eye-piece used was a 1-50, made by Allen Y. Moore, of this city.

When I stated 20,000 as the limit, I held back a very large margin. In truth, the magnifying power used was about 30,000 diameters.

"Four Inch" seems inclined to place me in the same boat with Prof. Francis Gerry Fairfield (whose accounts of high power I have read with great amusement), but I assure him that I stand ready to back up my claims by actual demonstration.

Now, I respectfully ask Prof. Fairfield to explain—logically—how he obtains such wonderful results from a cheap French 1-10, and under a power of over 12,000, combines, "fine definition and pentration, and extraordinary resolution." My own cheap French objective will not yield such fine results (and, by the way, this cheap triplet is a "fine lens"—worth, at par, just $4.00).

But when we come to the wide angles and nicest workmanship, as seen in this 1-6 (and let me add that Prof. J. Edwards Smith, held the helm in the engineering of this fine glass), we are out of the domain of commercial triplets, and enter the region of correcting collars, hemispherical lenses, Woodward prisms and high eye-pieces.

And now, Dr. Blackham, allow me to thank you for your instructive and interesting article on penetration. Penetration, (more properly focal depth), *is* a fault, and I am thankful that my objectives are not seriously disturbed by that interesting nuisance. However, lest your readers be misled, I will add that sometimes (not often,) I have use for that much talked of article, and at such times I employ the aforesaid cheap commercial French triplet, which has—just $4.00 worth of penetration *and nothing else.*

I wish to correct a mistake which I made in my letter to the June number of this journal. I used the term *homogeneous immersion* in speaking of my duplex 1-6. This glass is *not* homogeneous, but is limited to oils having a less refractive index than *pure* cedar oil; my sample of cedar oil being considerably lower in refraction than the *pure* article. With this lens I can focus from the top to the base of the hemispherical dots of *P. angulatum*—thereby arriving at results that *could not* be obtained if penetration were present.

Very respectfully,
NELLY A. ROMEO (not Mrs.)

Coldwater, Mich., July 28, 1880.

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Salicylic Acid as a Preservative.

Ed. Am. Jour. Microscopy—Salicylic acid has been strongly recommended in this journal as a preservative, and I have had very good success with it in mounting vegetable preparations of all kinds. One difficulty, however, is that it dissolves very sparingly in water, and alcohol produces changes which are frequently undesirable. It is well known that salicylic acid dissolves freely in a solution of borax, and it is also familiar to most persons that borax itself is quite efficient as a preservative. It, therefore, occurred to me to combine these two, and I have found that two parts of salicylic acid and one part of borax dissolve completely in half an ounce of glycerine, and that this solution when mixed with three parts of water, forms a most excellent preservative fluid for coarse organisms. More delicate preparations should be mounted in the above solution diluted with five parts of water.

Preparations mounted with this solution are very durable, and there is no danger of the salts crystallizing out and spoiling the object. In addition to this, I find that it is very easily kept in a cell of almost any kind.

A. MICKLE.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Buffalo Microscopical Club.—Regular meeting June 28th, 1880. A very interesting address of much practical value to the workers of the club, and to microscopists in general was delivered by Dr. Carl Seiler, of Philadelphia.

In the absence of Mr. Kellicott, the President of the club, Dr. Barrett was called to the chair.

Dr. Seiler, the President of the Biological and Microscopical Sections of the Academy of Natural Sciences, at Philadelphia, and Lecturer on Laryngoscopy of the University of Pensylvania, being in the city, delivered a very interesting lecture before the club.

Dr. Seiler took for his subject "The Mounting of Microscopic Specimens," and gave a clear and practical exposition of his methods, both verbally and by blackboard illustration. The preservation of tumours and cancers was dwelt upon and the process of preservation described. Specimens of cat's tongues, exhibiting trichinæ, were shown. Dr. Seiler stated that this disease was common among cats, and most liable to be found in the upper muscles and tongue; in fact, he stated that he knew no cats that had none. Of the address we present the following outline:

Dr. Seiler began his remarks by stating his experience in hunting up slides in Europe, and his unfortunate experience in not finding very many which were considered first-class. He stated that all new beginners should confine their work to certain simple tissues, and not branch out too much in the beginning. One thing well learned in preparing specimens is better than numerous attempts on varied preparations. The stomach of a frog was mentioned as being a good subject for the beginner. A good specimen was stated to be one in which the histological elements were clearly defined, so as to not tire the eye in examination. The process of preparing the stomach of a frog was detailed as follows: Obtain a small sized frog, take out its stomach and place it in 50 per cent. alcohol; allow it to remain three days. Let there be a good supply of fluid, about four times the bulk of the immersed object. Then place in 75 per cent. alcohol for three days more, and remove to 85 per cent. solution for three days, and lastly in 95 per cent. alcohol or Squibb's absolute alcohol. This process will harden the specimen so that it will feel like a piece of soap, and be in condition to place in a section cutter to cut. The Doctor stated that it was difficult to cut sections free hand with a razor, and that a good knife and section cutter were indispensible to perfect work. The knife should be straight, hollow on one side, flat on the other, and in use should be pushed from the operator as the muscular sense of the extensor muscles is more developed than that of the flexor muscles. The knife should be held at an angle with the surface of the section cutter, which will prevent wavy sections from being made. The bevel of the cutting edge of the knife must be made true in honing. Experience alone will accomplish this. Dr. Seiler described his knife-holder for adjusting the angle of the beveled edge of the knife to the surface of the object-holder, which also allows of a perfectly uniform motion when the knife passes through the section of material in the section cutter. Sections as thin as the 1-1000 of an inch could be cut in this manner which would show but one layer of cells on examination. It requires considerable experience on the part of the operator to do such nice work, however. After the sections are cut, they are to be placed in 95 per cent. alcohol for ten or fifteen minutes for the purpose of de-hydration; then into the staining fluid which is prepared as follows: Carmine No 40, 1 drachm; borax, 3 drachms; alcohol, 12 ounces; water, 6 ounces; mix and filter. Throw away the filtrate and dissolve what remains on the filter in one quart of water and evaporate over water-bath to one pint. This is termed Woodward's lilac fluid.

After the section has remained in the staining fluid for a few minutes it is placed in a solution of hydrochloric acid one part and alcohol four parts until it assumes a rose color. It is then to be washed in several changes of alcohol and finally left in absolute alcohol before mounting. The doctor mentioned the preparation of logwood or haematoxylin for staining, and said that a mordaunt was required to cause it to stain evenly, this mordaunt being alum.

For mounting, the Doctor recommended an alcoholic solution of Canada balsam, and he described his method of mounting as follows: Place the section in alcohol and float it on a cover glass. Wipe off the bottom of the same, and put a drop of balsam solution on the specimen. Place it in a dust-tight place and allow it to remain for twenty-four hours, then warm a glass slide, placed upon a self-centering turn-table, put a drop of benzole on the balsam, and invert the cover glass with the specimen on it on the slide. It will then be found to be ready for "ringing," with dammar or any other varnish. The Doctor preferred dammar dissolved in chloroform and benzine as a "ringing" material, and recommended to use the brush very lightly charged so as to prepare "a path" for the subsequent rings of cement. In this method of mounting no pressure is required to flatten the specimen, as it remains in contact with the lower surface of the cover glass.

Mounting in glycerine, Dr. Seiler said, was not generally applicable to permanent mounts, inasmuch as this medium has a tendency to make the preparation granular in time, but it was invaluable in certain cases, and therefore he gave a description of the process, which is as follows: Immerse the object in a solution of glycerine and water, half and half, for twenty-four hours; then place in strong glycerine for twenty-four hours until transparent. Then place the specimen upon a glass slide, put upon it the cover, remove the excess of glycerine by syringing with water (having placed a spring clip upon the cover previously to keep it in place,) and set it on end to dry. When all the water has evaporated, cement the cover to the slide by "ringing" it with the following preparation: Cox's gelatine, 1 drachm; acetic acid No. 8, 1 ounce; gum ammoniac, 10 grains. After the ring has set, immerse the slide in a solution of 10 grains of bichromate of potash in 1 ounce of water and expose to the light, thus making it absolutely insoluble. Instead of this, "Farrants solution" may be used for mounting.

Dr. Seiler stated that he would be pleased to answer any question which might be asked pertaining to the subject, whereupon Dr. Howe rose to ask what "imbedding material" Dr. Seiler preferred. The lecturer responded that he acknowledged the omission of this important point, and stated that after many trials he had found a mixture of paraffine two parts, and mutton tallow one part, the best, and stated that he had never found this material to shrink away from the well of the microtome or the specimen.

Dr. Howe then described his method of imbedding in elder pith, after which Dr. Seiler described the use of carrot as an imbedding substance.

Mr. George E. Fell, the Secretary of the club, then asked Dr. Seiler for his method of injecting the vascular system, referring to an interesting specimen of injected intestine of a cat, prepared by the Doctor, then under the microscope. The Doctor, in answer, said that the best animal for injection was a young cat, as its capillaries seem to be stronger than those of any other animal. The material used for injection was prepared as follows:

No. 1—Carmine - - - -	2 drachms
Water - - - - - -	3 ounces
Ammonia - - - - - -	q. s.
Nc. 2—Cox's gelatine - -	2 drachms
Water - - - - -	2 ounces

After heating the second solution add the first, and stir in dilute acetic acid, drop by drop, until the color of the solution changes to a bright scarlet. Then open the thorax, remove the heart from the pericardium, and cut off the apex of the heart, opening both the right and left ventricle. Then drain all the blood from the cat, insert the nozzle of the syringe into the aorta, tie it and proceed to inject. Very soon after the pressure has been kept up on the piston of the syringe, a resistance will be felt, which indicates that the injecting fluid has reached the capillary network which must be overcome by increased pressure, and the injection must be thrown in until it flows out through the right ventricle. The heart should then be tied around the nozzle of the syringe in order to fully distend the vessels, after which the cat is to be placed in ice-water to allow the gelatine to set. It is customary to kill the cat with chloroform before putting it through this preparation.

Previous to the close of the meeting the thanks of the club were tendered Dr. Seiler for his very practical address, and after examining a number of sections of the Doctor's preparation, the society adjourned.

Manchester (Eng.) Microscopical Society.—At a meeting of this society, recently held in the Mechanics' Institution, a paper on "Animal Tissues" was read by Henry Hyde, Esq., when some of the secrets of Dame Nature were lucidly divulged to those present by means of chalk and blackboard, the illustrations being some millions of times larger than the actual objects. Modern biological science would never have made such strides as it has done in recent years except for the as yet crepuscular light which is drawing upon us through the tube of the microscope. To the ordinary observer the brain and the nerves appear to be composed of fibres, but with the modern aids to our vision the fibres vanish, and numerous tubes appear upon the field, the walls of which are very distinct, and contain a fluid which may be seen to flow from their broken extremities on pressure. Each of the fine fibres of muscle is composed of bundles of much smaller ones, or tubes, and these are crossed by lines, which have received the appellation of muscular striæ. Muscular contraction, the cause of motion in animals, is supposed to be produced by the relaxation or approximation of these transverse striæ. In dissecting or mounting parts of insects, the operator will very frequently and accidentally come across exquisite examples of such tissue. Our microscopical readers may therefore keep a lookout for objects of this nature, and when found, immerse them in a weak solution of Price's glycerine, increasing the density gradually. In this way the softest and most delicate tissues swell out and become more transparent, whilst no chemical change is produced in the specimens. Then mount it in glycerine with four or five drops of acetic acid to the ounce, and press the cover well down so as to spread the object and decrease its thickness. If granular matter is mixed up with it, take the cover off, and run glycerine and acid over the object, so as to wash it and not disturb it; then replace the cover, and ring it with marine glue or cement which will withstand glycerine.

During the conversazione the president (John Tatham, M.D.) called attention to Baker's new dissecting microscope, the tubes of which are placed at a convenient angle for the operator. The erecting prism with which it is furnished is a most valuable addition; for it is irritating to find that when we have desired to move an antenna, or desmid, or diatom, a little more in the centre of the field, we have most successfully achieved a diametrically opposite result. Of course this is the consequence of looking at objects inverted, as is usual in all microscopes unless an erector be used. In Baker's instrument the binocular prism erects the object and adapts it to the double tube at one and the same time.

Washington Teesdale, Esq., of Leeds, sent specimens of his extraordinary fine tracing on glass with a diamond. Some of the lines did not exceed one twenty-thousandth of an inch apart, yet the highest powers of the microscope available on that evening discovered no irregularities in his work.

The exquisite *Floscularia ornata* was found in abundance near Manchester, during a ramble arranged two weeks previously. The rain came down in torrents; but the enthusiasm of the party was in no degree cooled by it, for the floscule in its peculiar jar-like home, and looking very much like an active living little yard brush, was an ample reward for hardships endured.

The secretary exhibited a well-prepared specimen of human tissue containing the *Trichina spiralis*. We understand that the man to whom it originally belonged was afflicted with trichinosis for twenty years. The tissue was perfectly crowded with the pests coiled up in their cyst form. Dr. Hogg informs us that the trichinæ maintain their living properties in decomposed flesh, that they resist immersion in water for weeks together, and when encysted may, without injury to their vitality, be plunged in a dilute solution of chromic acid for at least ten days. On the contrary they perish and are deprived of all noxious influence in ham which has been well smoked, kept a sufficient length of time, and then well boiled before it is consumed. Let us then be thankful in this beans-and-bacon season of the year for the last-mentioned crumb of comfort, notwithstanding the dismal and may-be not distant possibilities of trichinous ingestion.

The Central New York Microscopical Club.—A regular meeting of the Club was held on the evening of June 29th, at the office of Dr. Aberdein, in Syracuse, President Collins in the chair. The present officers were re-elected for the ensuing year.

A paper on the general principles of mounting objects was read by Dr. Aberdein. The President exhibited two specimens of *Hydra vulgaris* under his instrument. Various mounted objects were exhibited and discussed by several of the members, after which the meeting adjourned.

The Elmira Microscopical Society.—The first meeting of this Society was held May 13th, 1880, the microscopists of this city having congregated in the dining room of the Surgical Institute, and there formed themselves into the society above named. The following officers were elected to serve one year: S. O. Gleason, M.D., President; D. R. Ford, Ph.D., Vice-President; Thad. J. Up de Graff, M.D., Secretary and Treasurer. A committee of three was appointed to draft a constitution and by-laws, for the government of the society. The next regular meeting will occur on Saturday evening, May 29th, when a plan for intelligent and profitable work will be decided upon.

The Society can muster ten good instruments and an equal number of enthusiastic observers, from whom the journal will hear in due time. As we grow older we hope to wax stronger. This communication is to simply notify the JOURNAL OF MICROSCOPY of our existence, and that it will speedily hear from us again.

THAD. J. UP DE GRAFF, Secretary.

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EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales and purchases for cash must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Pleurosigmas and many other diatoms, marine algæ, and much miscellaneous material, in exchange for good mounted objects; correspondence invited. M. R. Booth, Longmeadow, Mass.

Well-mounted slides of human pathological specimens, viz.: Sarcoma, carcinoma, fibroma, and epithelioma, several varieties of each, also lung in pneumonia, kidney in Bright's disease, for other well-mounted pathological or histological slides; send for list. Henry Froehling, 59 N. Charles Street, Baltimore, Md.

In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

To exchange for a microscope or accessories, a double barrelled breech-loading, laminated, steel barrel shot gun. F. O. Jacobs, Newark, O.

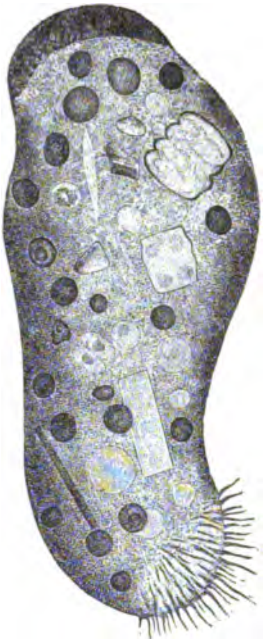

Fig. 1.

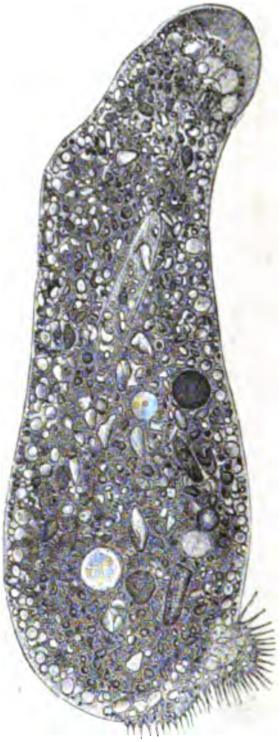

Fig. 2.

PELOMYXA.

Eng. by A. T. Cuzner.

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AND
POPULAR SCIENCE.

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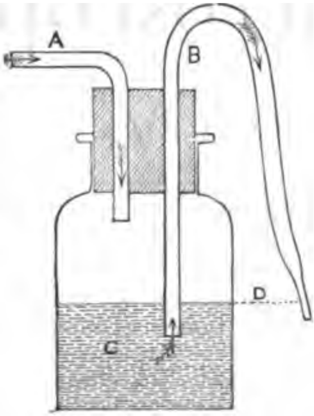
Mounting Bottle for Glycerine.

BY DR. S. W. FLETCHER.

IN USING glycerine for mounting microscopic specimens, especially if they are to be preserved for any considerable length of time, it is desirable to exclude dust, and air bubbles, and every one who has used glycerine, knows how difficult it is to do this. A slight modification of the common wash-bottle used in chemical laboratories, has for several years served me well for this purpose. The accompanying diagram of this glycerine bottle, drawn to a scale of half an inch to the inch, will be readily understood. It is simply a wide mouthed glass bottle of an ounce or two capacity, closed with a cork pierced with two holes, through which are passed the two snugly fitting glass tubes, A and B. These tubes are bent as shown in the diagram; A, reaches a little beyond the cork at each end, and has a little cotton loosely filling the middle third of the tube. The tube, B, reaches a little below the surface of the glycerine, C, in the bottle, and the other end is drawn out into a capillary tube of about twice the calibre shown in the diagram. The bottle being partly filled with glycerine, the cork with tubes, is inserted, then B is to be pushed down, or drawn up, as may be necessary, so that when the bottle is setting on a level table, the plane of the top surface of the glycerine in the bottle shall be about one-tenth of an inch higher than the smaller extremity of the tube B, as is shown in the diagram by the line D; then, with the mouth, blow into the tube A, until the glycerine escapes from the tube B, free from air bubbles; if now the drop of glycerine, which will most likely be attached to the end of the tube, be removed with a rod, the finger, or otherwise, the tube B will be a siphon, which, so long as the bottle is kept level will remain full of glycerine for any length of time without escaping, free from dirt, and free from air bubbles; but, if the bottle be inclined towards D, the capillary attraction, which holds the glycerine in the tip of the outer leg of the siphon is overcome, and it escapes drop by drop. When all you wish has escaped, hold the bottle level, remove the drop of glycerine from the end of the tube, set the bottle on a level table, and it will be ready at any time to give you a drop of clear glycerine by merely inclining it to one side. When the bottle is once arranged the only special cares needed are, to set the bottle level and to remove the drop of glycerine from the tip of the tube, so that it may not keep dropping, and to push the tube, B, a little lower as the glycerine is used. Before you get accustomed to using the bottle it is well enough to set it in a saucer, or cup plate, so that if you neglect these cares, no harm will be done except to empty a little glycerine from the bottle.



MOUNTING BOTTLE FOR GLYCERINE.

The size of the tubes A and B described, has seemed to me better than any other I have tried; if too small, the glycerine does not flow freely, and if the tip of B is too open the glycerine escapes too readily.

* * *

— I think it worth while to embrace the opportunity of informing students that microscopic observations, such as those which form the basis of the present work, do not require elaborate and high-priced instruments. Such a microscope as is made by Zentmayer, of Philadelphia, Beck, of London, or Hartnack, of Paris, and sold at prices ranging from $50 to $100, answers all ordinary purposes. The instrument should be furnished with two objective powers, of which the higher should be at least 1-4th or 1-5th of an inch focus. A still higher power being occasionally required, I have found an 1-8th or 1-10th objective of great service.—*Leidy in "Fresh-Water Rhizopods."*

On the Relation of Medium Power Objectives to Micro-Biology.

Read before the American Society of Microscopists at the Third Annual Meeting, in August, 1880.

LITERATURE.

(1) THE AMERICAN JOURNAL OF MICROSCOPY—What it Ought to Be and Do. By W. G. Lapham, in American Journal of Microscopy, Sept., 1879.
(2) CONCERNING SCIENTIFIC JOURNALS. By W. G. Lapham, in American Journal of Microscopy, March, 1880.
(3) PELOMYXA PALUSTRIS. By W. G. Lapham, in American Journal of Microscopy, July, 1880. Continued in subsequent numbers.
(4) DR. CARPENTER ON ANGULAR APERTURE. By W. G. Lapham, in American Journal of Microscopy. May, 1878.
(5) THE SAME. July, 1878.
(6) ON OBJECTIVES. By W. G. Lapham, in American Journal of Microscopy, Nov., 1878.
(7) THE MICROSCOPE AND ITS REVELATIONS. By Dr. W. B. Carpenter. Fifth Edition.
(8) PLEUROSIGMA ANGULATUM. By Nelly A. Romeo, in American Journal of Microscopy. June, 1880.
(9) FRESH-WATER RHIZOPODS OF NORTH AMERICA. By Joseph Leidy in Report of the United States Geological Survey. Vol. xii.
(10) UEBER RHIZOPODEN. By R. Hertwig und E. Lesser, in Archiv f. Mik. Anat. Bd. x.
(11) PRACTICAL HINTS ON THE SELECTION AND USE OF THE MICROSCOPE. By John Phin.
(12) RELATION BETWEEN THE LIMIT OF THE POWERS OF THE MICROSCOPE AND THE ULTIMATE MOLECULES OF MATTER. By H. C. Sorby, in Nature, Vol. xiii.

I AM not a scientist, nor have I any claim to that honorable and honored title. But looking on from the standpoint of an outsider—of an outsider eager to welcome any advance, and pained at any blemish, however slight, I am compelled to notice three evils in Biology, evils so great that I would consider any life well spent that should labor for their effacement, better spent perhaps than is the life of many a hardworking naturalist.

Of these evils, perhaps the greatest is the absurd methods of publication employed by most investigators, and this I have already noticed and suggested remedies for in (1) and (2). The second evil I have also slightly noticed in a memoir on a rare amœboid form now in course of publication (3); it consists of an almost total lack of scientific precision in biological writings, so far at least as concerns the clear and exact meaning of words, so that I sometimes think, not from any natural egotism, but from sheer vexation of spirit, that I am almost the only biologist who has any notion of the teachings of logic concerning class-names, and the methods of *Definition.*

But the evil to which I would now call your attention, though quite as important, is of an entirely different nature, and consists in the fact that scarcely any biologist selects for his work the best possible set of objectives. On this subject in general, I have already written three short papers, (4) (5), (6), but these I may disregard since they were written from a standpoint radically different from that which I now assume. In them I disregarded all considerations of time, space, and money, my purpose being to ascertain what constitutes a "best possible set of objectives," regardless of all such considerations. Now this is well enough when one is writing for *manipulators* of the microscope—for men who have no thought of *time*, and who would as soon spend a year as a day in the examination of a single object; who take no account of *space*, and are satisfied with a working distance of 1-80th of an inch; who have no need to spend much *money* on books and periodicals, and can, therefore, well afford to buy the most expensive instruments; but when we come to Micro-Biology, and set out to ascertain the best possible set of objectives for the *investigator* in this department, which I, for one, would not seek to elevate above that of the student of the microscope itself, we find a problem far more difficult of solution, so difficult in fact, that I expect to see no substantial agreement for some years. And this difficulty arises from the fact that in Micro-Biology, which I would define to be the study of living things, in section or entire, by means of the compound microscope, the investigator *must* seek, in every possible way, to economize as to time, space, and money; and if he attempt to do the work of the manipulator, in addition to that of the biologist, the probabilities are that he will fail of success in both. As well might he attempt to unite chemistry with biology, and to make for himself all needful analyses of the objects which he daily subjects to microscopical examination. *Some* knowledge of chemistry and *some* knowledge of manipulation he undoubtedly must possess, but if he attempt to become an expert in either, his days as a biologist are numbered, nor can he hope, in the distant days of a happier future, when more perfect knowledge shall have brightened all human life, to be remembered as one of that noble army which, in increasing the knowledge, increased the happiness of the race.

But I have no need to produce evidence as to the supreme value of time and money to him who, first securing a solid foundation in the shape of an innumerable host of facts with which he himself has come face to face (not mere word-facts), aims at advancing his chosen science by means of original research. One item, however, is deserving of notice. So far as I know there are not, in this whole land, more than two or three scientific libraries worthy of the name, so that financial economy is here of more than usual importance, since the scientist must *buy* nearly everything ever published upon the subject of his researches, and not only this, but he must buy, along with the memoirs of importance to him individually, very many of no importance.

Dr. Carpenter "considers as object-glasses of *medium* power the 1-2 inch, 4-10ths inch, 1-4th inch, and 1-5th inch," (7). In these days, however, when with a good 1-4th inch, we can see about everything that can be shown by any objective, this classification is not acceptable, and I shall consider as objectives of medium power, only these three, the 1-2 inch, 4-10ths inch, and 1-3rd inch. What I have to say as to these medium powers, refers solely to a certain 4-10th inch which Mr. Tolles made for me more than two years ago, and if I seem to praise it unduly, it is not because of any wish or right to detract from the merits of other opticians, but for the simple reason that I have never seen a 4-10ths inch by any other maker.

Of this glass I once wrote (6)—"Under a 1-2 inch eyepiece and amplifier (1000 diameters), it *defines* the markings on *Podura* in a superb manner. I have seen *Podura* shown by Prof. Smith, in Cleveland, and by Dr.

Edmunds, in London. There are, perhaps, no better manipulators in existence, and they used the finest glasses. I have also myself made many tests to see how much was gained by the use of a 1-6th and 1-2 inch eye-piece, (1,200 diameters), as compared with a 4-10th, 1-2 inch eye-piece, and amplifier, (1,000 diameters). I have not seen a finer glass than the 1-6th, of which I speak, but the 4-10th, not only defines *Podura* and other tests in an astonishing manner, nearly equaling the 1-6th, but it does this *over the whole field* and its penetration is much greater." I am now inclined to think that this language was too strongly in praise of the 4-10th; certainly an expert manipulator, having an eye for minute differences which I can never hope to appreciate, would think so, but I was and am inclined to err on the side of strength rather than give too little praise to the 4-10th as compared with the 1-6th. In my first article on this subject, I wrote: "With the 1-2 inch eye-piece (power of 500 diameters), illumination and definition are both very fine. With the 1-4th inch eye-piece (power of 1,000 diameters) illumination and definition are both good. I never yet saw daylight poor enough to render a 1-4th inch eye-piece useless, with this 4-10ths inch objective, (4). As to illumination and definition under lower power eye-pieces, they seem almost too fine for common use. I consider brilliant illumination to be very important, for the reason that, in many cases, good definition of object cannot be obtained without it, no matter how perfect the corrections. As to resolution, it is sufficient to say that the 4-10th resolves *Pleurosigma Angulatum in balsam* finely (4). These statements, I believe, now as then, to be correct, with the exception of the last sentence, which is far too slightly in praise of the 4-10th.

What then can the 4-10th do on the "Möller Probe-platte" *in balsam?* This question is one which I cannot answer perfectly, as I have never had it tested by a perfect manipulator. But I can tell you what I can easily do with it under a 1-4th inch eye-piece and with no sort of complex or time-consuming procedures as to methods of illumination, *but simply with a common hand-lamp, a small concave mirror, and a bulls-eye condensing lens,* and using that simple and cheap affair, a "Zentmayer Histological Stand," *without any sort of diaphragm.* I need scarcely say that the last three diatoms, 18, 19, and 20, are not resolved, but No. 17 is resolved and finely. As to 16 and 15 I am not so certain, although I presume that good manipulation would show them clearly. But let us assume that the utmost power of the 4-10th is the resolution of No. 14, and confine attention to this diatom and those of inferior value as tests, for the higher numbers, especially 16, the famous *Surirella gemma,* are difficult tests for the finest objectives.

Number 14 then is well resolved, and at the same time defined as to its edges and coarser markings. The resolution of No. 13 is almost equal to any I have ever seen, though I cannot say the same of No. 12, which is, however, well resolved. And now we come to the famous *Pleurosigma angulatum,* concerning which I was much amused to find that under a certain "cedar oil immersion" 1-6th, belonging to Nelly A. Romeo, "these diatoms throw off their garb of hexagons, and come out in their true apparel—*round dots,*" (8). As for me, I have never had any difficulty in seeing the *dots* on this diatom with my 4-10th inch objective, and well shown they are, though not as well as by my homogeneous immersion 1-10th of Tolles. It is now scarcely necessary to speak of the performance of this 4-10th on the less difficult diatoms of the plate. Suffice it to say, that in my opinion, scarcely anything is gained, on these diatoms, by any objective of higher power. Indeed the gain is not great on *Pleurosigma angulatum.*

From this study of the Möller Probe-platte, I have come to a certain conclusion as to the value of such a 4-10th inch objective to Micro-Biology, and this conclusion I will now state as a hypothesis to be tested, after which we will inquire as to the probable loss and gain that would result from the general adoption of such conclusion, which is: *No biologist ought ever to use an objective of higher power than a* 4-10*th inch.*

The complete and perfect proof of this lies in the following statements, the amplification of which will constitute the remainder of this essay. The use of objectives that will show much of anything more than can a 4-10th, involves an expenditure of far more time and money, and a loss of working distance; as compensation for this increased expenditure and loss, there is not seen enough more to make the investment a good one. *In other words, with a good* 4-10*th you can see nearly everything that in these days Micro-Biology has to show.* Let us first see how it is with this proposition.

I do not propose to prosecute this search throughout the whole of Micro-Biology, but will merely glance at those departments of Proto-Biology which would be most apt to show the falsity of the proposition. Let us take first the diatoms. With these I am not very familiar, having seen only the fresh-water species, as is also the case with those other groups which I wish to examine, the Rhizopoda and Flagellata.

Dr. Carpenter says: "It is neither the *only* nor the *chief* work of the microscope (as some appear to suppose) to resolve the markings of the siliceous valves of the Diatomaceæ; in fact, the interest which attaches to observations of this class *per se*, is of an extremely limited range," (7). I have very little sympathy with such sentiments, but I do contend that it is most certainly not the business of the Biologist to attempt the resolution of such diatoms as are too difficult for the 4-10th of 100°. But such diatoms are in my experience, extremely rare.

This seems conclusive, at least so far as concerns the fresh-water diatoms, and we will now turn our attention to that department which is to me the most interesting, and to which I have given, both here and in Germany, the greater part of my leisure time for nearly two years. The following quotation from the superb work of Leidy on Rhizopoda (9) is here in place. "I think it worth while to embrace the opportunity of informing students that microscopic observations such as those which form the basis of the present work, do not require elaborate and high-priced instruments. Such a microscope as is made by Zentmayer, of Philadelphia; Beck, of London, or Hartnack, of Paris, and sold at prices ranging from $50 to $100, answers all ordinary purposes. The instrument should be furnished with two objective powers, of which the higher should be at least 1-4th, or 1-5th, of an inch focus." As to the 1-4th or 1-5th spoken of by Dr. Leidy, he would probably admit them to be inferior to a first-class 4-10th of 100°. At any rate such is the case, and it follows that such a 4-10th can show about everything to be seen of these Rhizopods. In Leidy's work on these forms there are 48 plates, containing each about 25 figures, as an average, making in all about 1,200 figures. Now of these 1,200 there are not, I think, more than 50 that are magnified 1,000 diameters and above, and of these 50, many could have been shown quite as well with a power of 500 diamters. But a power of 500 diameters is obtained with the 4-10th inch objective, and not at the sacrifice of definition to any noteworthy degree. In fact I would not ask for better definition than I get with the 4-10th under a 1-2 inch eyepiece, and while on this point I may as well say that those of you who have had occasion to read many biological memoirs, know well that it is a great rarity to see a representation of an object magnified more than 700 diameters, and this power the 4-10th can give with little loss of definition. Now as regards these Rhizopoda, I know, and some of you may know, that there could not be a better test of the hypothetical conclusion which I am seeking to make non-hypothetical. These forms abound in structures exceeding difficult of definition on account of their extreme transparency, and in structures exceeding difficult of resolution on account of transparency plus minuteness. Nuclei which almost defy detection, they are are so transparent, clear expansions of sarcode, most delicate pseudopodia running out into the invisible, minute granules which may or may not travel along these pseudopodia, and are, therefore important and worthy of careful observation, crystals almost as minute and characteristic of certain forms, shells, sometimes provided with spines as fine as the finest pseudopodia, and in complexity of structure and minuteness of component parts, or surface markings, rivaling the diatoms. These and other features of the Fresh-water Rhizopoda make them even more worthy of the application of the highest power objectives than are the diatoms themselves. In fact, now that I recall all that I have seen and read of these wondrous forms I will omit all consideration of the Flagellata, most flagellæ being easy of definition in comparison with the tips of many pseudopodia. I may remark, however, that I have never yet failed to detect a flagellum where one was to be seen, save in *Bacterium termo*, and a very few *zoospores* of *Algæ*, and this with a 4-10th.

Consider *Actinophrys sol* and *Arcella vulgaris*, two of the commonest Rhizopods. In one, the structure of the nucleus, in the other, that of the shell, has only recently been made out, by Hertwig and Lesser, (10) in 1874; yet these things I have no great difficulty in seeing with a 4-10th. They are not as difficult as *Pleurosigma angulatum* in balsam, and there are more difficult structures among the Rhizopoda which can be well seen with the 4-10th.

But why multiply examples? I may as well say at once that I have found in my studies of the Rhizopoda, very little gain over the 4-10th by the use of the Tolles' 1-6th of 180°, with which I can resolve *Amphipleura* in short order.

But the *Podura* scale you exclaim!

Dr. Carpenter says: "That the sharp and distinct bringing out of the exclamation-marks of the Podura scale, constitutes the most valuable proof of the fitness of an objective of high power for the purposes of scientific investigation," (7). This I admit, but nothing more of the structure and nature of these exclamation-marks can be learned by means of any objective than by a good 4-10th. This I am prepared to demonstrate to any one who cares to see it. And now I may just notice a very simple discovery that I made while studying Podura, and which relates to the most expeditious mode of correcting an objective for thickness of cover. I found that after the most careful and tedious process of correction in the ordinary way, the same result, or nearly the same result, could be easily and quickly reached by this simple method. First, get tolerably near correction, and then turn the collar in opposite directions until on each side of the point of starting, which you know to be somewhere near correction, you have a point which is *certainly* worse than the starting point. Then take one-half the distance between these two points and the thing is done. It is much easier to correct a 4-10th of 100°, than a 1-6th of 180°, so much easier, in fact, that this is a very great objection to the use of a 1-6th. In proof of this I may say that on a certain Podura scale, when the collar of my 4-10th is at 5, the markings are not seen in anything like a respectable manner. The same is true at 9, the correction being, according to the above rule 7, and in fact about 6 3-4, 7 1-2 being seen to be worse than 7, and 6 1-2 to be better than 6.

I have now demonstrated, so far as time will allow, that "with a good 4-10th you can see nearly everything that Micro-Biology has to show."

Although it is well to "test your theories by your experience," it is also well to test your experience, which is very limited, and therefore not perfectly conclusive, by such theories as seem to be well grounded in the nature of things. Let us see, therefore, what theory has to say concerning this proposition, and, in so doing, we may, in great measure, ascertain what experience would be, were it of unlimited amount.

Let us turn again to the Möller Probe-platte, for here lies in part, the explanation of the fact that we gain so little by the use of high power objectives.

It will be remembered that the 4-10th clearly resolves No. 14. Now this diatom, according to a table given by Phin, (11), has 63,000 lines to the inch and I presume that the number is, in reality, nearer 70,000, since, according to this same table, Smith counted 85,000 and other observers 75,000, Morely alone giving 63,000 lines as the true number. Assuming, then, that 70,000 is correct, it becomes at once clear how very near to the limit of microscopic vision the 4-10th goes. The proof of this lies in the following quotation from a very important paper by Sorby, (12), which is based upon the researches of Helmholtz, who is the personification of authority in these matters. Sorby writes: "Taking everything into consideration, the agreement between observation and the theory is so close as to make it extremely probable, and to justify the conclusion that the normal limit of distinct visibility with the most perfect microscope is one half of the wave-length of the light. If so, we must conclude that, even with the very best lenses, except under special conditions, light itself is of too coarse a nature to enable us to define objects less than 1-80,000th or 1-100,000th of an inch apart, according as a dry or an immersion lens is used. We must also conclude that, *as far as this question is concerned*, our microscopes have already reached this limit, whatever improvements may remain to be made in other respects." Now I have not the least doubt but that a 4-10th can be made to show 80,000 lines to the inch, if indeed this be not already the case, so that we have only to consider the value of these additional 20,000 lines to Micro-Biology. That they have some value I admit. The only question is, how much?

Consider these facts, which no one here will dispute. With a power of 400 diameters you can see, *other things being equal*, very little more than with 200 diameters; with 200 very little more than with 100, and so on down, until we reach the statement that very little more can be seen with a power of 2 diameters than with the naked eye. But with a power of 2 diameters we can see objects twice as small as those smallest objects that are visible to the unaided eye, and it follows necessarily that since these objects which can be made out with our best immersion objectives, and which represent the limits of microscopic vision, are not twice as small as those visible to a good 4-10th unaided by accessories, but only one and one-quarter times as small, extremely little is gained, in microbiology, by the use of such high power objectives, even less than is gained by a power of two diameters over the naked eye.

It will be noticed that had I placed the limit of resolution possible to a 4-10th at 63,000 lines to the inch, the lowest estimate of the number upon the 14th diatom of the Probe-platte, the argument would still hold true, and I consider that it is as certain as any argument well can be.

But there is another method by which the same result is reached. In order to discover these additional 20,000 lines, it is necessary to make use of an illuminating ray of *extreme* obliquity; and what is the result? If your object, as is almost always the case in Biology, be somewhat opaque, you have miserable definition, so that it is rare indeed that the Biologist can use the angle of illumination that is necessary in order to see those objects which mark the limits of vision.

These are the reasons why we so seldom see, in biological memoirs, any indication of the use of a power higher than 500 diameters, and I need scarcely say that here again the combined experience of all investigators is in most perfect harmony with theory.

Please suppose now that I have made out my case, and that henceforth no biologist will ever use an objective of higher power than a 4-10th. What is the loss and gain? And first as to gain. Let us take the most common case, that of the investigator who seldom or never has occasion to use a power lower than about 100 diameters. He need never *change objectives*, but obtains all needed varieties of amplification by simply changing eye-pieces. He spends very little time in *correcting* his objective, on account of its extreme sensitiveness. He spends no time in the application and removal of *immersion fluids*, nor has he any need of those diabolical contrivances, *accessories*. In these four ways he saves *a vast amount of time*, for any manipulator will tell you that to see the utmost possible in any unknown object is a problem requiring often many days of patient labor, by means of many different powers and methods of illumination.

He saves money. His outfit ought not to cost more than $100, while that of the manipulator ought to cost, in these days, at least $1,500. For the researches of Dallinger and Drysdale have shown that, for the finest work, a 1-25th objective is at times desirable, and, of course, the lower powers, both immersion and dry. Then the stand ought to cost $300, and when we come to figure in all sorts of accessories, we see that $1,500 is a low price to put upon such an outfit as a manipulator ought to have.

But our investigator saves *greatly* in working-distance, and if time would permit, I might go on to show how extremely important is this item; how the Germans have employed with great success the "hanging drop," not only in "life-histories" of minute forms but in quite different investigations; and how often it is needful to have the object immersed in so great a quantity of fluid as to make the use of a 180° objective almost impossible. But I forbear. Those of you who are investigators will know without telling, and those who are not, will continue to think that a working-distance of 1-50th to 1-80th of an inch is enough.

Now as to loss. Our investigator cannot see some few things that he might have seen with high power objectives. This is all there is of loss.

But there need be no loss whatever. If I employ a shoemaker when I want shoes, do I lose or gain ? Surely the Biologist when he has reason to think that such labor would be rewarded by discovery, can send his objects to a manipulator for thorough optical analysis, just as he gives the chemist certain objects for chemical analysis, and for the same reason. I have no need to tell you that "division of labor" is the great secret of higher and more perfect life; the application of this principle to biology is the sole thing for which I plead. In order, however, that Science may obtain the full benefit of this principle we ought to have one thing. Let us have a great national *University*, wherein scientists may help one another, and let there be found there a perfect *library* and professors of every subject wherein man finds delight and profit, professors of diatoms, of rhizopoda, of infusoria, of birds, and frogs, of fishes and snakes, and of all other departments of research; and let us have there Professors of *Microscopical Manipulation*.

W. G. Lapham.

Note.—In using the words "biologist" and "investigator," I had in mind men who propose to discover, or to refute, *general laws*; not men who merely aim at increasing the number of special facts. These words are used, therefore, in a somewhat unusual manner, as is also the case with "manipulator," by which is meant not simply one who knows the microscope, its optical laws and the art of making it do its utmost; but one who knows also enough of Biology to enable him to make discoveries; to see *all* that is to be seen in any object. For example—Dallinger and Drysdale, supposing them to know only enough of Biology to do the work they have done, (and such knowledge, if obtained from the biologist would require very little effort), are manipulators. As to whether such investigators have any claim to the name biologist is of no consequence here.

W. G. L.

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— The Rhizopoda (Gr., *rhiza*, root; *pous*, foot; root-footed animals), are mostly microscopic beings, rarely just visible to the naked eye; though some are sufficiently large to appear as conspicuous objects. Their minuteness is amply compensated by their multitude and world-wide distribution; essentially aquatic, they occur wherever there is moisture. Commencing from one's own doorstep, they may be found in almost every damp nook and crevice, savanna and marsh. pool and ditch, pond and lake, sea and ocean, and from the greatest depths of the latter to the snow line of mountains. By far the greater proportion are marine, and their tiny shells enter abundantly into the composition of the ocean mud, and abound in the sands of every ocean shore. They appear to have been the first representatives of animal life on earth; and if there is any truth in the theory of evolution, they represent our own remotest ancestors. Having existed for ages, their remains have largely contributed to the formation of the marine sedimentary rock —*Leidy in "Fresh-Water Rhizopods."*

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Pelomyxa Palustris.

(*Continued from page* 171.)

LITERATURE.

(1) A Text Book of Botany. By J. Sachs, Translated from the German.

(2) Fresh-water Rhizopods of North America. By Joseph Leidy in Report of the United States Geological Survey, Vol. xii.

(3) On an Undescribed Indigenous Form of Amœba in Ann. and Mag. of Nat. Hist., iii, Vol. ii. By G. C. Wallich.

(4) Pelomyxa Palustris. By R. Greef, in Arch. f. Mik. Anat. Bd. x.

(5) Ueber einige in drr Erde lebendr Amœben und andere Rhizopoden. By R. Greef in Arch. f. Mik. Anat. Bd. ii.

(6) The History of Creation. By E. Hæckel, Translated from the German.

(7) The Anatomy of the Invertebrated Animals. By T. H. Huxley.

THERE are cases, however, in which the ectosarc *seems* to be bounded by a membrane; such a case, I think to have found in Pelomyxa, in which the double contour at margin is plainly seen *in places*, without the use of any reagent.

But what if this "line," which has every appearance of being the optical expression of a membrane, be, not a secretion, but protoplasm itself? Evidently, to call it a "membrane," would destroy the definition given, and since we must have some name to connote the attributes given as essential to all true membranes, we must seek another for this object, which is most certainly protoplasmic and probably pure protoplasm. All such objects I propose to call *pseudo-membranes*, and would thus define the term. A pseudo-membrane is a dense thin layer of protoplasm, enclosing, partially or wholly, the ectosarc of amœboid organisms. The wall of the contractile vacuole is probably very similar to the pseudo-membrane, and I am inclined to think, from some words of Sachs,—(1) page 41—that there are other classes of objects which resemble it very closely and which careful comparison might show to be entitled to the same name. But as such comparison would result either in a change of definition or in nothing, I will refrain: the definition pretends to nothing more than "good enough for the present."

It is very difficult to prove the existence in Pelomyxa of a true ectosarc, on account of the fact that *in almost every case*, the granules *are not confined to the endosarc*, but so completely fill the interior as to leave no hyaline border of measurable diameter: in fact no hyaline border can be detected, save in rare instances, though, without doubt, it is always everywhere present. (The diameter of the pseudo-membrane is far too small to be called a "border.")

I must now notice a species of Pelomyxa which Leidy (2) has described under the name of P. Villosa. He writes: "In most respects, the animal under consideration accords with the characters assigned to *Pelomyxa palustris*; but in the frequent and almost constant possession of a posterior villous process, it best agrees with *Amœba villosa*. Under the circumstances, I have named it *Pelomyxa villosa*, and have the impression that all the forms may, through later investigations, be proved to be but different stages of the same species."

What is a "*villous process?*"

The German term for this rare phenomenon is "Zottenhang," which means a tufted appendage similar in appearance to a lock of short hair. One of the first to describe it was Wallich, who thus writes concerning the appearance in his Amœba villosa (3): "One portion of the ectosarc is densely studded with minute papillæ, which in the quiescent state of the Amœba are of nearly uniform aspect and size. When the Amœba moves, these papillæ or villi vary in length and now and then several coalesce so as to form processes more nearly resembling ordinary pseudopodia, although still of minute proportions. The villous patch which occupies probably from 1-50th to 1-70th of the entire superficies appears frequently to be employed as a prehensible organ." It would be impossible for me to give of these minute and shadowy objects drawings equal in faithfulness to those of Leidy, and I therefore offer figures 1 and 2 as fair copies of two of the best representations of *P. villosa* that Leidy has made. Both figures are magnified about 250 diameters, figure 1 being by reflected, figure 2 by transmitted light. In both the villous patch is at the posterior and relative to the direction of motion and in fact this is always the case: wherever we find anything like these villi, and they occur in many different species, we find that the motion of the organism as a whole is away from them. My own experience accords best with the villi as represented in Fig. 1, but the forms vary greatly in the same individual. I suppose that I ought here to attempt a definition, if for no other reason than that of being consistent, but I must admit my inability to reform Biology all at once, and, therefore, may allow myself the same freedom with words that every Biologist takes, and has always taken, regardless of precision. At any rate, these villi are, as to composition, pure protoplasm; this, every writer admits, and it is enough for my purpose. They come and go and change their shape quite like pseudopodia, and their occurrence at posterior end of body, together with their prehensile power is of no importance here. There are, however, some facts concerning them, which are of importance as showing that Leidy was certainly in error, in supposing that the presence of villi in his *P. villosa* was proof of its being distinct from *P. palustris*, and as this is the only evidence he offers it will be sufficient to show its weakness. Greef (4) found these villi in some few examples of P. Palustris, and I have myself seen them upon individuals that had been kept under observation for some hours, and which showed no trace of them until towards the end of their confinement under cover glass, so that the only evidence that Leidy can offer is, that in his experience, villi are *more common* than in the examples met with by other observers.

But this matter of the *more or less common* occurrence of "organs" or shapes which are not persistent but which disappear even while we look, has long enough hindered the progress of the study of amœboid forms, and the sooner some definite "plan of action" is agreed upon, the better. In regard to them I would say at least this much: if form a, ever has shape x, (whether x represent the whole organism or only a part thereof, is of no consequence if x be inconstant), it is of the same species as form b, (providing that b *sometimes* has x and is otherwise in agreement with a), regardless of the relative frequency of x in the two forms.

The proof of this is found in a certain definition of "species," which I hope sometime to demonstrate in an "Essay on Classification." The definition which I hope some day to see adopted is simple enough, and is as well adapted to species having no sexual reproduction as to those more complex. It reads—*All forms that are interderivable, any one from any other, are of the same species.*

As to these villi there is one fact which makes it probable that they may occur on *any* amœboid organism whatsoever, under certain conditions, and this is the fact of their *more or less frequent occurrence on species the most distinct.* Thus Greef found them (5) on *Amœba terricola, A. gracilis* and (4) *P. palustris*, Wallich on *A. villosa*, (which is certainly as distinct from *P. palustris* as could be desired) and Leidy (2) on small amœbæ which he *suspected* to be the young of *A. villosa.* All this goes to show that perhaps these villi are of no importance as specific marks: in this case *A. villosa* would be identical with *A. princeps* of Ehrenberg.

I have said that in P. palustris "*the granules are not confined to the endosarc*, but so completely fill the interior as to leave no hyaline border of measurable diameter." The explanation of this I would seek in these facts so well stated by Leidy (2). "*Pelomyxa villosa* I have usually found to be so opaque, except in young specimens, that the different elements of its interior structure are undistinguishable without the animal is submitted to considerable pressure, or it is actually crushed. In habit, it is exceedingly gluttonous, and it is remarkable for the manner in which it gorges itself with food and other materials of different kinds." "Quartz-sand is a frequent and abundant material mingled with the food and other constituents of the endosarc. Not only fine but coarse particles are swallowed, but they appear always to be directly in contact with the granular and other matters of the endosarc, and not contained in vacuoles or water-drops, as ordinarily is the case with most solid food. In many individuals, the quartz-sand has appeared to predominate over everything else in the endosarc, and such specimens which were literally bags of sand I formerly described as a species with the name of *Amœba sabulosa.*"

My experience has been almost entirely with these "bags of sand," and therefore it is, I think, that I have scarcely ever been able to detect any *clear* ectosarc. The figures I have given from Leidy show P. palustris as I have been accustomed to see it, save that the villi are usually absent. It will be noticed that in these figures there is no hyaline border, except in places here and there, and this is even more true of Leidy's other figures save two. And yet he writes: "Body composed of a *clear* ectosarc with a finely granular endosarc." "Animal nearly opaque, appearing by transmitted light brown or black *with hyaline border.*"

In my experience this is only true of those very rare individuals which are comparatively free from *ingesta*, and, therefore, more transparent. and this is also the experience of Greef. However, the point is not of great importance. What I wish to determine is as to the *necessity* of the ectosarc's being *clear* in order to be ectosarc. In other words, how ought we to *define* ectosarc?

It is extremely probable that most writers have no desire to know what they mean by this term, but it happens to be of some importance to me just now in connection with the pseudo-membrane, and as I am unable to find a definition, it seems necessary to invent one.

"In the lobose Protoplasts, more than in any other Rhizopods, the sarcode mass of the body exhibits a tendency to differentiate an exterior, *usually* more consistent layer of protoplasm, which, though actually continuous with the interior, *ordinarily* more fluent protoplasm, seems like an investing membrane, preventing the escape of the latter. *For convenience*, the two portions of protoplasm, differently related in position, have been appropriately termed the endosarc and the ectosarc. The ectosarc appears as the exterior *clear* protoplasm; the endosarc as the interior granular protoplasm," (2). In these words, in which the italics are mine, Leidy comes as near to a definition as is often the case. With most writers, however, the greater density of ectosarc is considered essential, and certainly I know of no case where it is more fluent than the endosarc, and in fact it is usually an easy matter to prove the greater fluency of endosarc, or rather the greater fluency of protoplasm the more nearly central is its location. Thus Greef writes concerning the more transparent examples of Pelomyxa to the effect that the vacuoles of endosarc move about more rapidly in the interior, less rapidly as they approach the outer hyaline zone, (4). But is it essential, as Leidy seems to think, that the endosarc should be granular. the ectosarc non-granular? *Pelomyxa palustris*, as it seems to me, most certainly disproves this position. For it is conceded by all that the ectosarc is the principal seat of motion of that mysterious power by which these "lowest forms" change their shape and position, and when we see individuals of this species in their modes of motion and in structure identical with other individuals, except in the matter of a "hyaline border," we cannot deny to the former the possession of an ectosarc, merely because we cannot see it free from granules and sand-grains.

By all it is conceded that no one can say where the ectosarc stops, or where the endosarc begins, but that the one passes by imperceptible degrees into the other, and this, in spite of the fact that usually the *boundary as marked by granules* is distinct enough. It seems certain, therefore, that the ectosarc is not *essentially* hyaline. We have left, then, two attributes, and these I would consider essential, so that the definition must read: When in any *continuous* mass of protoplasm the density increases as we go from any point in the interior to the nearest point of surface, the exterior portions of the mass are called collectively "ectosarc," the interior "endosarc."

We may consider such a mass as composed of concentric layers, one within the other, and each of infinitesimal thickness, and we might say that any layer is ectosarc to the one next within; but in practice, the term ectosarc, will always refer to a layer of protoplasm of *considerable thickness* investing the endosarc with which it is *continuous*. And this brings us back to the pseudo-membrane, the definition of which must now be somewhat changed so as to read—any layer of protoplasm investing partially or wholly a protoplasmic mass with which it is *discontinuous*, as evidenced by its having a distinct double contour. For definition of ectosarc we would have—any layer of protoplasm investing partially or wholly a less dense protoplasmic mass with which it is *continuous*.

It may be objected that this last is no real definition, since a definition is "a formula which enables us to know whether any object or portion of any object whatever, is to be called by the name or not." This objection is certainly valid, for the definition given does not inform us as to each and every portion of the "protoplasmic mass," whether it belongs to the endosarc or ectosarc. Nevertheless, definitions are merely means for the securing of certain scientific ends, of which the greatest is precision, and by means of this imperfect definition, together with other factors suited to each species, all needful precision may be obtained. For it is to be noticed that the definition leaves us in doubt in regard to nothing, save the line of demarcation between ectosarc and endosarc, and of this it is impossible for it to speak, as the line has no existence as a *constant* boundary, but varies in position with every species. Usually its position is determined by the granules in interior, so that we say "they are confined to the endosarc," and where this is not the case, we must fix upon some other mark by which "precision" can be secured as to the particular species in hand. Thus in *Pelomyxa*, we may say that the *vacuoles* are confined to endosarc.

The definition given may be best expressed so as to show its nature in symbols, thus:—The attributes connoted are, a, b, c. x—x representing the "line of demarcation" whose *position* is unknown in general, but assignable in each species. The definition may be said to contain a "variable," and is, therefore, quite peculiar, so much so, indeed, that I do not remember ever to have met with such a definition either in works on Logic or Natural History.

The reproduction of Pelomyxa palustris, and its relation to the Darwinian theory of Evolution.

I have said that "Pelomyxa can be divided into any number of parts, and each part lives and acts as did the parent mass." I scarcely think this quite true. In my experience it has always seemed as though a portion of the protoplasm was killed in every act of artificial reproduction, and the parts killed seemed to be those in immediate contact with the knife or needle. Often, also, in transferring a specimen from the bottle to the slide, it will be more or less mutilated, and, as a consequence, no doubt of such rough treatment, dead protoplasm may nearly always be detected in places. From such places of mutilated and dead protoplasm I have often seen creep out minute *amœbæ*, which were without trace of organization, having neither contractile vacuole nor nucleus, and not even differentiated into endosarc and ectosarc: mere lumps of pure homogeneous protoplasm, containing at most a few granules. These "amœbæ" (which I may call such, rather than invent a name), I have little doubt originated in this same "rough treatment," whereby portions of the protoplasm are often killed, and whereby other portions in near contact with the same, become separated from the parent mass, and creep away as independent "organisms." The noteworthy part of it, however, is that in all cases these "amœbæ" soon die, nor is it probable that their death is due to their not containing nuclei, but rather to the *shock*, which killed *in situ* certain portions of protoplasm with which they were originally in contact. These facts show, I think, that although there exists in Pelomyxa no such interdependence of one part upon another as we are accustomed to see in more complex organisms, and although a shock of injury does not travel far from its starting point, yet there is an easily reached limit beyond which artificial reproduction by knife or needle cannot go.

It seems probable that at the dawn of life upon this globe, when only *Monera* were in existence, reproduction occurred solely in this artificial manner. In those primordial times, when the "conditions of life" were such as to make unnecessary any such methods of reproduction as prevail at present, when "spontaneous generation" was the rule, and biogenesis the exception, and when inorganic substances were all sufficient as food, the homogeneous protoplasmic masses, which constituted the first beginnings of life, were probably far larger than any of the Monera of the present day. It might then have happened that rocks and stones, falling into shallow waters from the face of overhanging cliffs, were the occasion, now and then, of some such *pseudoreproduction* as we now see when small "amœbæ" are produced, as in Pelomyxa, by mutilation of a large individual. This is made more probable from the fact that these "first organisms" must have been far less sensitive than Pelomyxa, so that the detached "amœbæ" so produced would have continued to live on indefinitely. However, all this is of no importance, since such artificial multiplication proceeding from *without*, can scarcely be called a "mode of reproduction," and we may, therefore, say that the "first organisms" did not reproduce themselves.

Of the Monera, Haeckel writes: "These very simplest of all organisms yet known, and which at the same time, are the simplest imaginable organisms, are the *Monera* living in water." "Simpler or more imperfect organisms we cannot possibly conceive," (6). As a just reply to this I quote from Huxley: "The simplest form of animal life imaginable would be a protoplasmic body, *devoid of motility*, maintaining itself by the ingestion of such proteinaceous, fatty, amyloid and mineral matters, as might be brought into contact with it by external agencies; and increasing by simple extension of its mass. But no animal of this degree of simplicity is known to exist. The very humblest animals with which we are acquainted exhibit contractility, and not only increase in size, but, as they grow, divide, and thus undergo multiplication," (7).

I conceive that the simplest possible "mode of reproduction," is quite different from that of self-division, which Haeckel seems to think the simplest imaginable, (as it occurs in his *Protamœba primitiva*), and that it arose out of the greater degree of motility that gradually came to be an important factor in the life of primordial seas. Motion from place to place must have been a comparatively late acquisition, for in this we have, I think, even in the lowest *amœboids*, something very similar to conscious volition; but let us confine attention to those motions which result merely in change of shape, and imagine a lump of protoplasm so inert that long continued observation is necessary in order to detect any change of shape. Let the motions gradually become more vigorous and varied, until we have a form which rapidly assumes shapes the most various, as is the case with some amœbæ. In such forms it often happens that a portion of the body becomes almost severed from the rest, not in any definite manner, as is always the case with self-division proper, which occurs in accordance with certain fixed laws, but simply as the result of a very strong tendency to continual change of form. Now if the lump of protoplasm be not sufficiently *individualized*, there will be nothing to hinder this partial separation from becoming complete, and so this greater degree of motility will result in a mode of reproduction. That this has actually been the case, and in fact the only method, perhaps for ages, by which reproduction occurred, seems probable; that it is of very rare occurrence now is certain, and this is perhaps explicable from the fact that the amœboids now living have no small an amount of individuality, as is shown by their active movements from place to place in search of food. In fact, although I have seen very many amœboids and a few Monera, and have often seen this partial separation spoke of, and quite as often read accounts of the same by other observers, I have never, save in *Pelomyxa*, observed any such primitive mode of reproduction, nor have I ever met with an account of any such observations as those I have now to submit. W. G. Lapham.

To be continued.

"Dry Mounts" for the Microscope.

BY F. KITTON, HON. F.R.M.S.

I HAVE read with much interest the remarks of my friend, Professor H. L. Smith, on the above important subject; but alas! I am unable to suggest a remedy.

The "damping-off" of dry mounts, particularly of diatoms, used to be (some twenty-five years ago) attributed to the imperfect washing of the diatoms: either the acid used in cleaning was not eliminated, or the water used for that purpose was impure; but preparations which showed no acid reaction, and which had been carefully washed with the purest distilled water obtainable, when dry mounted, still showed the presence of moisture. This was then accounted (?) for by the supposition that the supposed moisture was really condensation from the asphalt ring supporting the cover; I, therefore, mounted some covers perfectly cleaned (by boiling in acid, washing in distilled water, and afterwards heating them over a Bunsen burner) on some hard asphalt rings; the slides were heated sufficient to cause the covers to adhere, and when cold the latter were concave (the interior of the cell being nearly exhausted of air). These mounts (about a dozen) were carefully finished and then left upon my table for several months before examination. Some of them showed minute globules on the inner surface of the cover-glass, others minute radiating acicular crystals, and the remainder were perfectly clear.

This experiment being far from satisfactory, I tried "shellac" as follows:—Perforating a hole about ¼ in. in diameter, in a piece of "thick" thin glass, I covered the edges with the lac, and cemented two thin covers to it, and with a similar result to the previous experiment. I have also tried paper cells saturated with "shellac" dissolved in spirit, or soaked in paraffin wax, but in no case were they invariably successful. I have, therefore, come to the conclusion that the fault rests with the cover itself, and confirmatory to this opinion is the fact that the covers on balsam (hardened before attaching the cover) sometimes show similar deposits. A similar "sweating" almost invariably occurs on our oculars which has often been referred to an exudation from the "black" within the tube, but I think erroneously.

I have in my possession a small box of thin covers, selected by the late Wm. Smith, author of the "Synopsis of British Diatomaceæ," of which at least 30 per cent. exhibit traces of oxidation in the form of minute pits. Query—Would not these covers have shown the so-called "damping-off" if used?—*English Mechanic.*

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Meetings of the Microscopical Societies.

DURING the past month two notable gatherings of microscopists have assembled, one in Detroit and the other in Boston. We have in preparation very full reports of both meetings, with carefully prepared abstracts of the more important papers. These reports are too long to find room in the present number, and as we do not care to divide them, we shall publish them together in our next issue.

◆

The Wax Cell.

WE give a good deal of space this month to notes on the alleged failure of Prof. Smith's wax cells. His substitute, which we tried twenty years ago, we do not like as well as the wax, as we have found that pure shellac in all its forms, is very apt to separate from the glass after a time. We have carefully examined a number of slides of the mounting material of which wax forms a part. Some we find spoilt, others are good. It is evident that the dew may arise either from the object itself or from the mounting material. In the case of such objects as polycystina and diatoms, which have been exposed to low red heat, it it is unlikely that any vapors would ever be given off. And we have found slides of these objects both with dew and free from it. A good deal probably depends upon the quality of the wax, and the processes used in bleaching it. Where bleached by exposure to sunlight and water, and afterwards carefully melted, we believe no vapor will be given off. Where the wax has been bleached by the action of acids and chlorine, it is difficult to tell just what changes may occur.

A point which is of importance in this connection is the following: Amongst the directions for mounting in wax cells, one which has been generally given and very usually followed, is to soften the wax with turpentine at the point where the object is to be placed. When this has been done, and the cell closed immediately, the turpentine is sure to evaporate and settle on the cover. It there becomes oxidized or ozonized, so that it is no longer volatile, and it was undoubtedly this ozonized turpentine which resisted the high temperature alluded to by Prof. Smith.

We saw this difficulty some years ago, and instead of using turpentine to soften the wax, we use a copper wire, highly heated and held near but not in contact with the wax.

◆

A New Method of Using the Bulls-Eye Condenser for Illumination.

Many years ago Sir David Brewster suggested a method of using a hemispherical lens as a magnifier in which the rays proceeding from the object were reflected from the plane surface of the lens and transmitted through the latter in such a direction that the axis of the pencil as it issued, was at right angles to its direction as it entered. In this way, the magnifying power of the lens was doubled. It is now proposed to apply this principle to the bulls-eye condenser, and the light being allowed to fall upon one side of the convex portion and then, after suffering internal reflection, issuing in highly convergent rays from another part of the same surface that it first entered.

The application of the principle is an ingenious one; of its efficiency we are unable to speak.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

"Penetration"—Plus Some Other Things.

Ed. Am. Jour. Microscopy—In the last issue (August) of this journal, I read with interest an article entitled "Penetration."

Mr. Vorce, therein, states as follows:

"Fortunately for microscopists, penetration cannot be got rid of by the opticians, *except at the expense of the field of view*. And Dr. Blackham's beloved one-inch still retains *some of it* (italics mine)." A little further on I read—"for the mere definition of surface Dr. Blackham's *perfect* objective would of course excel, etc." While near the close of Mr. Vorce's contribution, I again read, "*then* comes the opportunity for the Doctor's *perfect* non-penetrating, surface-defining objective to get in its best work."

In these quotations, if Mr. Vorce means anything, it is to assert that Dr. Blackham's one-inch (of 30°) is a perfect objective. And resulting from this very "perfection" its field of view suffers in certain respects—just what, Mr. Vorce does not say.

Inasmuch as the *area* of field of view is principally controlled by the ocular employed, the inference becomes inevitable to me that Mr. Vorce refers to *flatness* of field.

Now for the facts: The one-inch in question was my property before Dr. Blackham ever saw it. When received by me from its maker (Mr. Tolles), three other objectives of lower angles (20° to 25°) accompanied it. I had also in hand my own, and then much prized inch of 20°, also a similar English glass belonging to a friend. Dr. Blackham's objective was tested by me in the severest manner, and was compared carefully with the glasses named above.

By reference to my note-book, I find as follows: "I see Nobert's 5th band (33,780 lines to the inch) 'clear across the field,' vertically and horizontally; plate reversed at each trial, lines plain when eye-pieced up to 740 diameters."

From *personal experience*, then, I judged the inch in question to be a very superior glass, and so informed Dr. Blackham. And now, at this date, without reference to "field of view," do I assert its superiority (penetration included) to any "long ago" English inch ever imported to this country.

Regarding the observation made by Mr. Vorce with an English inch made "*long ago*" (italics mine), the reader will at once see that the observations as related (i. e., without stating the entire thickness of the object examined, nor by way of comparisons presenting the work of other glasses over the same specimen) fail of *demonstrating* any point of value. When Mr Vorce shall desire to compare with Dr. Blackham's inch the work of his "long ago" English glass, I reckon the opportunity will be forthcoming. I feel tolerably sure that Dr. Blackham will loan me his objective at any time for such purpose.

Experiment. Let there be three houses suitably placed, at distance of (*a*) 100, (*b*) 300, and (*c*) 600 yards. Let it be required, using an ordinary field-glass, to describe these several houses as accurately as the glass employed will admit.

Now should this problem be presented to a boy 12 years of age, he would probably (provided he were not a first-class idiot) focus as accurately as possible the several houses in succession—for otherwise he would find, by sad experience, that should he "draw his bead" on (*b*), then (*a*) and (*c*) would be affected with "dimness."

We will now hand the boy a very much superior glass; let him again focus on (*b*); quite possibly he will now report, "I can now read a sign-board before invisible on the front of (*b*). The rear of (*b*) is slightly affected with "dimness," while (*a*) and (*c*) are terribly affected with said "dimness." Nevertheless, by separately focussing I am now able to tell you much more about either (*a*), (*b*), or (*c*).

Query: (To the readers of this journal.) *Which* of the two glasses used is the better one?.

Experiment No. 2. Premising that English one-inch objectives made "long ago" (I suppose at least from 6 to 16 years old) were not endowed with aperture greater than 20°, let it be required with such a glass, working the same with two-inch ocular, to repeat Mr. Vorce's observations on "a stained mount of utricularia," noting the results obtained.

b). Now examine same object with a wide-angled American two-inch objective, having conditions of field equal to the "long ago" glass, employing, however, the one-inch ocular, thus equalizing the amplifications. Again note results.

(*c*). Now repeat the foregoing observations using on the "long ago" objective the inch ocular, and on the American glass the one-half inch eye-piece. Note results once more.

(*d*). Repeat again similar to (*c*)—the English glass to take the one-half inch ocular, the American the one-fourth. Note results again.

I will be very grateful, not only to Mr. Vorce, but to any of my readers who will take the trouble (?) to *try* this interesting experiment. I have made many such, indeed scores of times. Inevitably my experience has shown:

First: That (*a*) and (*b*) *demonstrate*, I may say instantly, the superiority of the American wide-apertured two-inch over the inch as to any points of superiority claimed by Mr. Vorce in behalf of his English objective.

Second: By higher eye-piecing, as per (*c*) and (*d*), the higher the ocular the more apparent becomes the superiority of the American glass. Resulting that when the latter is fitted to the 4th ocular, details of structure may often be seen which cannot be displayed at all by any "long ago" one-inch extant.

Note. The reader is here reminded that the *working-distance* of the two-inch objective will be (approximately) *double that of the* inch glass. Consequently the former will exhibit the greater so-called "penetration." Make a note of that!

If Mr. Vorce will kindly *make the above experiments*, I can in advance assure him that he will no longer "long to possess that objective," which, according to "Dr. Blackham, is so faulty."

Memorandum—for the reader: In this connection I quote from an article of mine originally published in this journal for August, 1877. Referring to the work of inch objectives of wide apertures, I said as follows:

Suppose, for instance, I am making preparations, say of malignant growths (notice that this is not a diatom), * * I should, from the high-angled class of objectives, select the above-named inch of 45°. Why?

First: Because it has large working distance, which is not affected by high eye-piecing, etc., etc.

Second: Because this inch will show me structure up to 30,000 (I subsequently claimed 40,000) lines to the inch, etc., etc.

Third: Because of all glasses I have ever handled I can get the most work (I have in hand) out of it. For instance, its large reach (the so-called "penetration") enables me to focus through the different planes of the object, while the entire specimen remains fairly in view. I am further enabled to search through my mount with the least danger of allowing important structural elements to escape my attention—an important item.

Want of time and space forbids comment.

Regarding "mere definition of surface," allow me to say that this is *par excellence* the legitimate as well as the safest field for microscope investigations of an advanced nature over objects more or less opaque. Mr. Vorce very properly asks, "How much of the total of microscopical work is of that character?" and our microscopists may well ponder over this important and suggestive interrogatory. We all know too well that precious little work of this character *has thus far* been accomplished. And why?

I answer in manner following: All attempts to illuminate objects by reflected light under high amplifications had signally failed, until about five years ago, when Mr. Geo. W. Morehouse, of Wayland, N. Y., made the important discovery of the conjoint use of the vertical illuminator with American *immersion* objectives of wide balsam apertures. By way of demonstration, Mr. Morehouse exhibited the podura scale under amplifications of 4,000 diameters, as well as other objects.

Shortly afterwards another "microscopical showman," in like manner, resolved the Nobert 19th band, as also the Amphipleura pellucida. (Note: See last issue of this journal, page 175!)

Thus it appears that until five years ago there were no known means of working high powers with reflected light, and when we remember that the vertical illuminator proved to be a difficult instrument in the hands of one not expert either in its use or that of the wide apertured objectives—that probably 50 per cent. of those who have made the attempt have failed to use it successfully—the reasons become apparent *why* so little has been accomplished in this direction.

I have said this is a *natural* field of microscope investigation—we thus see things through the microscope as we see them day after day with the naked eye, namely: by light reflected from the surface. It often thus occurs that such eye-examinations of the surface suggests the propriety of dissecting the object into smaller and smaller parts, so that the object may be farther inspected in detail. The same holds good when it is under the objective and vertically illuminated.

Don't fail to note this point: The wider the balsam aperture of the immersion objective the better its conjoint work with the vertical illuminator. Here we have additional evidence of the value of wide apertures.

Right here, again, I would be greatly pleased if my readers, including my friend Vorce, would examine some presumably well-known object by the aid of widest apertured objectives and vertical illuminator. If human blood be selected as the object, and perchance *nuclei* are seen, it will be well for the present not to say anything about it, lest you be *sit down upon* as a "late wide-angled histologist."

Under the vertical illuminator the dry valves of the S. gemma surrender their true structure.

Look for yourself, and (probably for the first time) learn that these shells are enveloped in an *exceedingly* thin membrane, which, in most cases, is ruptured, or torn from certain portions of the shell, and that it is only through the opening thus formed that the underlying "markings" are truly seen. Finally try the same valve by transmitted light and see what a miserably false show accompanies the change of illumination.

[Note—to the reader: The vertical illuminator, of all instruments, deals with surfaces, and reduces the so-called "penetration" to its very (*ultimate*) minimum—I like it!)

On the principle of "killing two birds with one stone," Mr. Vorce whales me over Dr. Blackham's shoulders. "The repeated implication" seems to distress him more than the old time "plus 180°," which latter nearly caused the death of one or two I wot of—they both recovered after a restless fever—for which recovery let us be duly thankful!

In a lecture of mine before the Dunkirk Microscopical Society, on the eve. of Oct. 31st, 1876, and subsequently published in this journal, I affirmed "that most of the work in histology and pathology done with the so-called 'working lenses of narrow angle' would require further attention, and with wide-angled objectives, which recent advances of the optician had put at our command." And I further said "this revisory work is *now in progress*."

Many of my readers will remember that I was taken to task for these statements by Mr. R. Hitchcock, that a long controversy followed, Mr. H. finally granting (see past files of this journal) substantially that I was not so far in error after all. I quote from memory.

The first portion of my statement before the Dunkirk Society was founded on my knowledge of histological work *at that date* in progress in the hands of Cohnheim (1867—1872); Beale (1868); Stricker (1872); and others. All of whom had abandoned medium power lenses of low angles in favor of later high-power glasses of more extended apertures, such as 1-32nds of Powell & Lealand, the 1-50ths of Messrs. P. & L. Smith & Beck, including the later and much improved and extended apertures of Hartnack.

Well, let us see what was then being done. I quote from Stricker (Manual of Histology, 1872) as follows:

"The advances that have been made on our knowledge of cells and of the finer structures of nerve fibres, are the result of researches undertaken with the admirable instruments that *have been recently constructed*. (Italics mine. J. E. S.)

"In the present condition of our instrumental means of research, it appears advantageous to commence histological studies by means of general topographical examinations of the tissues with lenses of low powers, then to proceed to the examination of specimens * * with lenses of moderate powers, applying the stronger [i. e., higher powers. J. E. S.] only as a means of control for the penetrating power of the weaker ones, and finally to proceed to the examination of fresh tissues with the best means at our command.

"The value of these [recent. J. E. S.] high powers is strikingly illustrated by the investigations on the living cornea conducted by Recklinghausen and Kuine."

Here, then, is my authority for the first portion of my statement. Likewise for adding (2nd) that "this revisory work is now in progress."

Curiously enough, it remains for Mr. Vorce in the year of grace, 1880, to ask "what amount of work has been done over with wide-angled glasses, etc.," accompanying his interrogatory with an unbecoming fling at the "late wide-angled histologists," and thus marring the symmetry of his otherwise courteous and gentlemanly paper.

Let Mr. Vorce read a few of the older authors. By comparing the same with Klein's recent Atlas of Histology, he will arrive at a better acquaintance, not only of the older, but of the "late wide-angled histologists!"

But to return. I did make at Dunkirk—and lost no chance to publicly state, there and elsewhere—a conviction which an experience of ten hours of hard work daily and for months over the tube had forced upon me, namely, that a Tolles' 1-10th of aperture of 180° would excel, "for any and all work," any low-angled lens at that date extant, "be the same a 1-5th or a 1-50th."

This assertion, be it known, was strictly original with me, and was based upon *my own personal experience and observation*. The responsibility thereof rests with me. To this day I have never retracted one syllable of it. I am proud to have been its author. It was the DEATH-KNELL of the 1-50ths!!!

Lest I appear ungrateful, I beg here to digress so far as to gratefully acknowledge the hearty and effectual support received from Dr. Blackham, of Dunkirk, N. Y.

In conclusion, I respectfully call on Mr. Vorce to state *definitely*, giving names and dates, regarding the wild errors, "promulgated by some of the late wide-angled histologists." "I ask this for information," and not for controversial purposes. A sweeping statement of this character ought not to be made unless its author is prepared to produce his authorities (and good ones at that) when courteously requested.

J. EDWARDS SMITH.

Cleveland Hom. Hosp. College, August, 1880.

The Wax Cell.

Ed. Am. Jour. Microscopy.—All microscopists are sure to be interested in, and to give full weight to, anything which Prof. H. L. Smith writes about microscopical preparations, but I am sorry that he has felt obliged to condemn his own wax cell; for my experience has been decidedly favorable to it, and I should not like to see it entirely abandoned. I therefore beg leave to express my dissent from the fallacious logic of Prof. Smith's note published in your journal for August, (p. 173).

His sole ground for condemnation of the wax cell seems to be that a dew-like condensation appears on the cover-glass of this cell when used for dry objects. Now if this were a defect discoverable exclusively in wax cells, it might be fair to infer that the cause was in the wax; but, according to Prof. Smith's own testimony, and according also, I think, to very general experience, this troublesome formation is met with more or less in cells of all kinds, and is not worse in wax cells than in most others. I believe it is the exception to find cells entirely free from it amongst the slides of opaque objects usually purchased of the opticians. Prof. Smith is, therefore, not justified in singling out the wax cell for denunciation unless he has other reasons for it than those he has given. Indeed, he answers his own logic by admitting that the fault is not peculiar to wax cells, and that the kind of cement used has probably something to do with it, as well as lack of carefulness in the process of preparation. In these last suggestions I think he has hit the true causes. Possibly the trouble may be caused in some cases by emanations from the sheet wax employed, but my experience goes to prove that this misty condensation on the cover-glass is mainly due to the too free use of cements containing resinous or oily solvents, like turpentine or benzole, and I imagine that chemical analysis would show that the so-called "dew," is, in most cases, resin or oil, though sometimes it may arise from the specimen itself, if that is not thoroughly dry when put into the cell, and in some cases it is probably actually a re-crystalization of chemical constituents of the cements employed, as Prof. Smith suggests. But I find that when I employ only a cement composed of shellac dissolved in alcohol (as I usually do), and am careful to allow plenty of time for the completion of each step in the operation of mounting, and not to use more cement than is necessary, I am not troubled by the appearance of this "dew," if the specimen itself is thoroughly dry before being enclosed. When a disc of sheet-wax is centered upon the slide, and a hard rubber ring is laid upon this, and the whole is fixed by warming, I cannot conceive of a cell for opaque objects more free from possible vapors and condensations. Therefore, notwithstanding Prof. Smith's frank condemnation of his own wax cell, I am still of the opinion that he has invented the best cell for dry objects that has ever been used. C. F. Cox.

New York, August, 30, 1880.

Prof. Smith and his Wax Cell.

Ed. Am. Jour. Microscopy.—I am moved to sympathy by the lamentation of Prof. Smith in your last number. I have experienced all the trouble of mist on the cover of dry mounts, yet I think the wax cell has a value, and should not be hastily rejected. I have some of Cole's dry slides which are expensive, with the cell of elastic rubber covered with white zinc cement, which in a very short time required to be uncovered and the mist gotten ridden of. Part of the trouble with the wax cell is, that the cell is used with asphalt or zinc cement, which evaporates the turpentine and condenses it in the cell. Then again the wax cell is used as soon as made, and evaporation is again to be contended with. I have found no trouble since covering the whole cell with a thin film of shellac, and using shellac to fix the cover, provided the *day was a dry one*, and the cover is held for a moment over the lamp flame. Opaque objects require as much as any other objects, the greatest care in order to get rid of moisture, for if a particle of moisture is enclosed it will get on the cover. Mr. C. C. Merriman's suggestion given in this journal last year is also of value, theoretically, and it may be practically, if it can be done. He leaves a small opening, so that moisture may get out. My practical difficulty is, that I can't finish the cell without running the cement in and filling up the opening. It certainly would be practical if he would tell us how he avoids this. J. F. STIDHAM.

Columbus, Ohio.

Blood Corpuscles in Medical Jurisprudence.

Ed. Am. Jour. Microscopy—I have recently been engaged in the study of micrometric measurements in relation to Medical Jurisprudence. Naturally, my own observations and measurements, have led me to a decided opinion as to the ability of microscopists to identify human blood. Now an opinion, unless it be arrived at after some new and indisputable fashion, is not what is most needed for the furthering of a final decision of this *quæstio redata*, there being already competent and able men arranged on both sides, but it seems to me, that there is a more certain and accurate manner of arriving at a final conclusion regarding the matter, than any I have yet seen approached. It is a fact, that a number of experts are ready to back their opinion with an oath as to the identity of a blood stain with human blood. Notably is this true of Dr. Richardson, (Joseph G.), Dr. Piper, of Chicago, and Mr. Hyde, of San Francisco. Now I will propose to one of them, say Dr. Richardson, the following test. I will submit to him, enclosed in marked envelopes, five specimens of blood-stain, one or more of them from a healthy man, at the same time I will send a sealed letter to the editor of this Journal, (or any person well known to be interested in microscopy), containing memoranda of the specimens, as to the kind of blood contained in each, this letter to be kept until the result of his examination shall have been communicated.

I need scarcely say that a successful identification, under the circumstances indicated above, will go much further towards settling this mooted point, and establishing the ability of the expert, than any number of assertions and well written articles could do. On the other hand, if he fails, it is certainly much better that incapacity on this point should be recognized, and another source of contradictory evidence, possibly unjust suspicion and punishment, should be eliminated. I think most will agree with me that the above is a fair test, and a far more rational method than in endeavoring to settle the point in a case where life is involved, and no sealed envelope afterwards obtainable to determine who is right. Of course I am ready to alter the particulars of the test in any reasonable way the expert may suggest. What say you Dr. Richardson?

Richard H. Lemmon, M.D.

Castle Craig, Va., Aug. 30, 1880.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

The Biological and Microscopical Section of the Academy of Natural Sciences, Philadelphia.—A stated meeting of the Section was held Monday evening, Sept. 6th, Director Dr. Carl Seiler in the chair.

It being the first meeting after the summer vacation the time was spent in relating the work done by members since the last meeting.

Mr. Edward Potts gave a detailed account in a paper of some length, of the various life-forms to be found at Atlantic City, especially since the breakwater was built. He referred particularly to the Hydrozoa and Polyzoa. He had been able to gather many beautiful specimens which had found a home upon the stones of the pier recently constructed. We seem to have borrowed from New England many of the attractions of its rocky coast.

Dr. Seiler gave an account of the doings of the American Microscopical Society at Detroit, and of the Microscopical Section of the A. A. A. S., at Boston. A committee was appointed to arrange for the annual exhibition in October.

The Microscopical Society of Canandaigua, N. Y., was organized in June, with the following officers: President, Dr. N. T. Clarke; Vice President, Dr. S. Howard; Secretary, Prof. John M. Clark; Treasurer, Dr. John H. Jewett. Meetings are held each month. At the July meeting the President read an elaborate paper on "Polarized light." He illustrated the subject fully by diagrams and experiments, going over the light wave experiments of Tyndall, with turmaline crystals. The construction of various polarizing apparatus was entered into at length.

At the August meeting a paper was read by Prof. John Clark, on "The Hydra." There was a number of these polyps in zoophite troughs under various microscopes, and the Professor further illustrated his paper by a series of silhouette drawings or transparencies, which were shown against a bright light. The fifteen members present were much interested and pleased. The rush of doctors to the neighboring ponds the next day, was a source of wonder to the small boys who were frog hunting. The slimy sides and ends of lily-pads and sagittaria, were in great demand, much to the disgust of the feminine households, who warily watched the water pitchers and tumblers. We hope to publish regularly the proceedings of this live society.

Illinois State Microscopical Society.—At the May meeting of the Trustees of the Illinois State Microscopical Society, a section in Histology was organized for work during the summer vacation.

The initial meeting was held May 21, at which Dr. Lester Curtis was chosen President, and Dr. Frederick W. Mercer Secretary. Meetings the third Thursday of each month.

EXCHANGES.

Will some reader of this journal send me one or two undried specimens of *Bidens Beckii* Torr.? I will return the postage and pay the collector for his trouble, if he desires. Dr. Alfred C. Stokes, Trenton, N. J.

In whole or part exchange for an objective, about 1-6th, I offer 11 vols., unbound, of "The Nation," 1871, and July 1872, Dec. 1876. Rev. F. Hurd, Laingsburg, Mich.

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The Detroit Meeting of the American Society of Microscopists, August 17th, 18th, 19th, 1880.

BY GEO. E. FELL, BUFFALO, N. Y.

TWO days sail on Lake Erie in the summer months is an event to be appreciated by any reasonable being not subject to the usually transient complaint accompanying voyages by water. The little party of microscopists who left Buffalo Saturday evening, Aug. 14th, to attend the Detroit meeting, while they regretted the inability of many of their eastern brethren to accompany them by lake, assure them they missed a very enjoyable trip. Space was annihilated—time was not lost—for on the fine steamer the evenings were occupied with the microscope, the sea calmly acquiescing, and the daylight in very profitable social intercourse with the pleasant newly formed associates of the voyage. In fact, Detroit, that most beautiful City of the Straits, was at the gunwale almost before we had realized that the Queen City of the Lakes was some three hundred miles astern. If the members of the society could be induced at future meetings to travel in parties, so far as practicable, the pleasure of the meetings would be greatly enhanced, as to many the social acquaintances found, and the little coteries and conversaziones regarding mutual topics, both *en route* and at the meeting, are among the treasured results of the annual meeting of the society.

But to take up the subject of the report: The third annual session of the American Society of Microscopists began Tuesday August 17th, in the large hall of the Detroit Female Seminary. The building was well adapted to the purpose, having quite a number of rooms of convenient size, in which the different manufacturers of instruments and accessories could display their stock for examination, also for the use of the committees these rooms came into profitable use.

The society was called to order by the retiring President, R. H. Ward, M.D., of Troy, N. Y., who, after a few remarks, eulogistic of Detroit and its hospitable citizens, introduced President Elect, Prof. H. L. Smith, of Geneva, N. Y.

President Smith spoke briefly, saying that it afforded him great pleasure to meet the faces before him. They gave him assurance that the meeting would be successful in every respect. He expressed regrets at the absence of many who should have been present at the session, but considered notwithstanding this, the meeting would be valuable and beneficial to those present.

Prof. E. C. Wetmore, the President of the Griffith Club of Microscopy, of Detroit, in behalf of that Club, welcomed the visitors. He stated it was with some misgiving that the infant club of Detroit extended its open arms to its guests. He gave a brief history of the formation of the Detroit society, the difficulties they had encountered in becoming an organized body, and said they considered themselves only learners and infants in science, and really in need of the advice of a parent, and expressed the conviction that the local society would be greatly benefitted by this visit of the American Society to Detroit. Notwithstanding this, the Griffith Club cordially welcomed its guests to Detroit, and it was hoped that any imperfections in the arrangements would be pardoned as the offspring of inexperience.

Prof. Wetmore then introduced ex-Governor J. J. Bagley, who, in behalf of the citizens of Detroit, extended a further welcome to the visiting society. He said, "It was a pleasure to him to welcome the visitors to the beautiful city of Detroit. We welcome you with open arms and doors. We recognize your merit as men of science, knowing that science is the foundation of all fact. Poets and dreamers may create pleasant thoughts and fancies, but they fade away, and it remains for the scientists to demonstrate the solid foundations of fact. We know that a bumble bee can break up a picnic, but it remains for you to show the means by which the mysterious machinery accomplishing this effect is put in motion. [Laughter.] We all know and have heard the resemblance between a brass band and a mosquito, but it has remained for you to show the instrument which causes the music in the latter." A humorous allusion was here made to the "wicked flea," which was followed by rounds of laughter and applause. The speaker said further: "Men of science destroy bigotry and ignorance, and elevate mankind to a higher plane. When our ministers meet in their conferences and synods we outsiders attend—we don't know what for. I think they go in order to swap sermons. [Laughter and applause.] Interchange of thought is always enlightening, and I think it a good idea that we have met here. We welcome you cordially here, and if we have weak spots in us we trust your microscopes will not enlarge them."

President Smith in response said: "In behalf of the Society I return thanks for your hearty welcome. We do not come here representing any of the great commercial interests, but as humble students of nature. We are glad to know that science is not disparaged, the study of which by many is thought to begin in presumptuousness and end in infidelity. Science is human, but the objects it contemplates are divine."

Turning to Mr. Wetmore, the President thanked him for his efforts, which had resulted in the meeting of the Society at Detroit, that, had it not been for the invitation extended through Mr. Brearley by the Griffith Club, the American Society would probable have met elsewhere. He gave some well chosen words of advice and encouragement to the Club, and commended the arrangements they had made for the welfare of the society he represented."

An intermission of fifteen minutes was given, after which the Secretary, Prof. A. H. Tuttle read the report of the Executive Committee recommending to membership the following gentlemen: Hiram A. Cutting, Lunenburgh, Vt.; J. W. Crumbaugh, M.D., Lancaster, Pa.; John Phin, New York city, editor of The American Journal of Microscopy; D. R. Sexton, Rochester, N. Y.; Dr. S. O. Gleason, Elmira, N. Y.; T. S. Updegraff, Elmira, N. Y.; Lee H. Smith, Buffalo, N. Y.; F. O. Jacobs, Newark, O.; W. G. Lapham, Northville, Mich.; Nathan W. Lord, Columbus, O.; Sidney H. Short, Denver, Col.; Gen. Wm. Humphrey and J. F. Main, M.D., Jackson; O. W. Owen, M.D., E. W. Wetmore, Charles R. Ferris and Fred Seymour, Detroit. On being balloted for they were declared elected.

An invitation was extended by the Hon. Moses W. Field, tendering the Society an excursion in the evening to Wyandotte and return, on the iron steamer Grace McMillan. It was accepted with thanks.

The Secretary gave notice that the President's address would be delivered in Whitney's Opera House, Wednesday evening, at 8 o'clock. After the transaction of some routine business, the Society adjourned until 2.30 P.M.

AFTERNOON SESSION.

There was a much better attendance in the afternoon, many additional members putting in an appearance. Quite a number of ladies graced the audience, and the medical fraternity of Detroit and vicinity was well represented.

Mr. Geo. E. Fell, of Buffalo, N. Y., gave a description of a series of plates illustrating the structure of the human teeth. In explanation the speaker said these plates constituted a series of enlarged sectional drawings cut transversely, exhibiting the structure, microscopic and general, of a human molar tooth. The average size of the sectional views is about six inches square, beginning with a view of the grinding surface or top view of the crown of the tooth, and successively introducing the structure and conformation of the enamel, cementum, dentine, and pulp cavity, up to the fangs of the tooth as located in the alveolar portion of the superior maxillary bone. The exhibitor gave a very interesting description of the structure of the teeth, aided by the plates, which were marvels of ingenuity and neatness, being constructed of sheets of paper overlapping one another, colored to nature, and so constructed that the various sections could be unfolded and each successive layer of the interior structure of the tooth consecutively exhibited.

Mr. Fell stated that the drawings were prepared from a series of sections of human teeth made by himself sufficiently well to make out the structure with the microscope. His object in preparing them was to afford the medical and dental student another aid to the study of the structure of the human tooth. For the purpose of locating the sections he had prepared a modified copy (side view) of the tooth of Dr. F. G. Lemercier, of Paris, upon which the sections were represented by a series of transverse lines.

Prof. D. S. Kellicott, of the State Normal School, of Buffalo, N. Y., followed with a paper on "Lerneocera tortua," a parasite harbored by the cat fish, *Amiurus catus.* It was obtained from a fish taken in Oswego Co., N. Y., in July last, and was by no means plentiful, as few had thus far been found. The Lernean buries itself in the muscle just back of the pectoral fins; has a length of about six-tenths of an inch, and the body walls are unusually transparent. The internal ovaries are easily traced, and are bent back upon themselves for about one third of their entire length; the external ovigerous sacs are moderately long, and nearly straight.

The body is twisted half way round, so that the last pair of thoracic feet are uppermost. The parasite is provided with four pairs of swimming feet, quite similar in structure, viz: with a basal portion and two three-jointed fingers, bearing minute *setæ.* The head appendages are two lateral, each branched, and the one uppermost simple. The antennæ, mandibles and first pair of foot jaws were described.

Remarks were also made concerning its provisional assignment to *Lernescera* and with regard to its affinities to *Lernea* and *Lerneonema.*

Prof. Kellicott, previous to reading, provided the audience with cuts of the parasite, which aided materially in following his paper.

The next paper was on "The Relation of Medium Power Objectives to Micro-Biology," by Mr. W. G. Lapham, of Northville, Michigan. In this paper the author gave his views with reference to the use of different objectives upon different structures. He detailed the work of a 4-10th inch objective of wide angle of aperture, and concluded that for the ordinary work in Micro-Biology very little else was needed. He thought there ought to be a National University of Microscopy, completely furnished with a suitable library, and all the requisites to the teaching of microscopy in all its branches, etc.

The paper was discussed by President Smith, who opposed the views of the reader on several points. He did not believe a 4-10th inch objective was all that was needed for Micro-Biological work. Secretary Tuttle also disagreed with Mr. Lapham regarding the work which could be done with a 4-10th inch objective, and said that the microscopist who confined his microscopical studies within such bounds at the present time would not accomplish much.

Mr. C. M. Vorce, of Cleveland, Ohio, read a paper upon the "Penetration of Objectives—Is it a Defect or an Advantage?"

He considered the qualities of objectives with reference to their defining and penetrating properties, and compared the value of the different kinds of work done by them. He took the ground that objectives which have good definition, with a fair amount of penetration and show different layers of the structure of an object at one view, are better adapted to the ordinary uses of the microscopist than objectives with better defining properties without penetration.

In support of his views he cited the work of Dallinger (published in this Journal for August, 1878,) and quoted from that article to show that penetration, in so high a power as a 1-35th inch objective was regarded by Dallinger as of considerable value.

The quotation from Dallinger was as follows: "Most of the more difficult and delicate work was done with an entirely new lens made specially for me by Messrs. Powell & Lealand; and which is nominally a 1-35th inch lens. It was made specially for this class of investigation, for which it is admirably adapted. Its 'working distance' is sufficient; its 'penetration,' for such a power, is extremely great, its angle being moderate; and its definition is as sharp and clear, when properly used, as that of the finest 1-4th or 1-8th," etc.

The conclusion reached by Mr. Vorce was, that both high and low power lenses of both kinds were needed, viz: those in which definition was carried to the utmost limit, sacrificing the penetrative quality, and also others in which penetration was prominent, so far as possible with good definition; and that neither kind of objectives were suitable for all kinds of work. He considered the penetrative objective the most valuable in original investigation, and the defining objective of the greatest value in differentiating minute structure. He urged that makers of objectives should endeavor in some objectives to attain the best possible combination of defining power with penetration, and not devote all their attention to constructing objectives in which definition was exclusively aimed at.

The paper was discussed by Mr. Fell, who stated that he agreed with the reader in many respects, that he still believed there was use for the penetrating lens, although in advanced work, where differentiation of structure was the object in view, and in most original work, only lenses of wide angular aperture, with the best definition, should be used.

Following this discussion, Mr. W. H. Brearley distributed to the members and friends of the society the excursion tickets to Wyandotte, after which the Society adjourned until 10 o'clock Wednesday morning.

The excursion to Wyandotte, a pleasure resort on the Detroit river, some fifteen miles below Detroit, was a very successful affair. Some two hundred persons, consisting of the microscopists and their friends, participated. On arrival at Wyandotte, the party strolled through the grounds, which were finely illuminated, until the return signal, when they repaired again aboard the steamer Grace McMillan, where they were hospitably entertained on the return trip.

SECOND DAY'S SESSION.

After the reading of minutes, the Secretary read the report of the Executive Committee, recommending to membership the following persons:

The Rev. Wm. D'Orville Doty, Rochester, N. Y.; Rosa M. Redding, Newcastle, Ind.; Chas. Shepard, M. D., Grand Rapids, Mich,; W. B. Sprague, M. D., Detroit; Allan Y. Moore, Coldwater, Michigan; W. G. White, Buffalo, N. Y.; Wm. A. Clapp, New Albany, Ind.; John Sloane, New Albany, Ind.; Richard J. Mohr, Fairfield, Iowa; Albert McCalla, Fairfield, Iowa. The gentlemen named were accordingly elected members of the society.

An invitation to the society to visit the Detroit Scientific Association's museum, at Harper Hospital, in the afternoon, was accepted.

Mr. C. M. Vorce read the first paper of the day, which was entitled "The Microscopic Examination of Writings for the Detection of Forgery, etc."

The speaker treated the subject at length, saying that he had a great deal of interest in the matter, and directed his attention both to the verification of signatures and to general writing. He was free to say that he was as yet by no means satisfied with the results which had been attained, and thought that many valuable additions might be made to this branch of practical microscopy. He had considered first the general characteristics of writing; second, special characteristics, modifications of or departures from general characteristics. There were five elements which determined the character of a person's hand writing: The paper, the pen, the ink, the personal qualifications of the writer, and the conditions under which the writing was done. Any one of these being changed from the ordinary conditions the microscopic conditions of the writing were almost sure to be changed also. So far as the paper is concerned, its glazed surface is the only characteristic which affects writing. The harder and smoother the surface the better defined is the writing upon it, and the better chance there is of determining any erasure, change or interpolation. On paper of good quality, with a good pen and readily flowing ink, the lines of writing present a tolerably even contour, depending upon the rapidity, pressure, the amount of ink in the pen, etc. The speaker illustrated at length on the blackboard the various widenings or "webs" which are always found at points where two lines cross, explaining how a variation of speed, a change in the kind of ink, and other causes, affected this web. Upon rough paper the lines always have a ragged edge; the webbing is, if anything, less than upon hard, smooth paper. As to the pen, he stated that when a steel one was used, the paper always showed a distinct groove or cutting on its surface, especially at the edges of the heavy lines. When a pen is old and corroded, the paper looks as though cut with a knife. The various qualities of ink were discussed, together with the effect on the appearance of the writing which copying it in a letter press has. Some inks will not write well on paper that has been lithographed, running unevenly, as though the paper was greasy. By the fourth condition, the qualifications of the writer, the speaker meant his skill, method, physical ability, etc. A person much accustomed to writing usually writes at a good speed and without hesitation. The writing, in quality, is apt to look alike at all points on the page. Where writing is done slowly it is not so regular, and the curves are not so smooth and geometrical. Where a habitually light writer attempts to make a heavy stroke, the shading is irregular. The same is true where a person accustomed to writing with a heavy stroke attempts to write light. These differences are such that they can be usually discovered with the aid of the microscope, and when a writer concentrates all his faculties on the appearance and character of the writing, it never has the easy, flowing appearance which it otherwise would have. The tremor in the writing of aged persons he stated that it was nearly impossible to imitate. The fifth condition, the circumstances under which the writing was done, had as much to do with its appearance as any other cause. One who habitually uses a flexible gold pen writes very differently with a steel pen. The reverse is equally true. Persons who are accustomed to write sitting, usually cannot write as well standing up. The practical application of these and other facts in the examination of writing requires patient investigation, much of it apart from the simple use of the microscope. In the great majority of cases the microscopic investigation is utterly useless without a corresponding outside investigation. The signatures to letters are apt to vary more than those written elsewhere. Letters produced as specimens of a person's hand-writing are very apt to prove deceptive. Sometimes it is impossible from expert testimony to determine the character of the suspected writing. As an instance, the speaker related that he had in his possession a genuine promissory note in which a man had misspelled his own name in the signature. Had he died, and had there been a contest as to the signature, it could hardly have been decided as anything else than a forgery. Unfortunately, however, the man lived to pay the note, thus spoiling a very good chance for a nice case of expert evidence.

Ex-President Ward discussed this paper at some length. He believed that inquiries of this kind should consist of microscopic analysis, in connection with a broad and philosophic knowledge of the habits and peculiarities of the person who might have executed the alleged forgery. Under all circumstances a man's handwriting, he believed, would exhibit, when carefully examined, certain peculiarities which had become as natural to him as breathing, and which he could not rid himself of. A man might imitate a signature in its prominent letters and first syllables very successfully, but it would be simply a miracle if, when he came to the latter part of the signature, some peculiarity of his own handwriting would not unconsciously be imparted to that which he sought to imitate. The very fear of exposure, the nervousness from which few men at such times could completely rid themselves, would ensure the presence of some unconscious trait of the writing which would make its identification, where there were two or three words or more, almost certain. A well-known case in point was that of Wittaker, the West Point cadet, where among several hundred specimens of the students' handwriting, written carelessly and at times when they had no idea their penmanship would ever be examined by others, the specimens being marked in cypher, several experts, none of them knowing the conclusion which the others had reached, or whose handwriting it was that they had agreed upon, all selected the specimens which were known by the officers to be those of Cadet Whittaker.

Mr. Vorce also gave a number of other instances.

An invitation from M. R. Freeman, photographer, requesting the members of the society to group themselves in front of the building after adjournment, to be photographed, was accepted.

The next paper was by Dr. Carl Seiler, of Philadelphia, on "The Best Kinds of Mounting Material." Referring to the comparative merits of balsam and glycerine, he said the microscopists of both Europe and America were divided into two classes on this important question. Many believed that balsam should be the only material used in most cases, and others as decidedly glycerine. He was of the opinion that all tissues which can be hardened and cut into sections are best mounted in balsam, and such specimens as membranes, hairs, cilia, etc., are bested mounted in glycerine. If one wished to show delicate, fine lines, he should use glycerine. The advantages of balsam are that it does not destroy colors, makes a specimen clear, and prevents it from deteriorating. The disadvantages are that the specimen is apt to shrink, and in the slowness with which it dries. These objections can, to a great extent, be overcome by the correct method of using it. Dr. Seiler related his manner of using balsam alcoholic solution which he had found the best.

The advantages of the glycerine are that delicate membranes may be preserved, while its disadvantages are that it always interferes with the coloring. The specimen also tends to deteriorate. Specimens mounted in glycerine are very apt to suffer from leakage. There are substances which in some cases combine the advantages of both, without the disadvantages of either. Among these the speaker mentioned Farrant's medium and damar cement.

The topic was discussed by Dr. Younghusband, of Detroit, Dr. Seiler, J. H. Fisher, Esq., of Rochester, N. Y., Mr. Fell, Mr. Vorce, Mr. Walmsley, of Philadelphia, President Smith and others. In reply to a question of President Smith, as to whether a simple solution of balsam became cloudy in alcohol, Dr. Carl Seiler said if the balsam was evaporated to dryness, first the volatile oils were dispelled and the solution would be clear if the alcohol was first warmed.

Many interesting points were brought out in the discussion relating to different methods of mounting which we have not time to present.

AFTERNOON SESSION.

The Executive Committee presented the name of Harvey H. Chase, M.D., Linden, Mich., who was elected a member of the society. It was decided to adjourn Thursday afternoon, as it was thought the business on hand might be transacted, if the sessions were lengthened.

The Nominating Committee was elected, and stood as follows: C. M. Vorce, E. H. Griffith, J. H. Fisher, President H. L. Smith, Prof. D. S. Kellicott, Secretary A. H. Tuttle and Prof. E. W. Wetmore.

President Smith stated that a fine Bausch & Lomb half-inch objective of 98° angular aperture had been placed in his hands, and was to be presented to the preparer of the best specimens (slides) showing adulterations of common articles of food. A committee of three, consisting of Messrs. Walmsley, Kellicott and Fisher, was appointed to examine the slides.

The President announced that Dr. Geo. E. Blackham, F.R.M.S., who was unable to attend the meeting, being seriously ill, had presented to the society his work on "Angular Aperture of Microscopic Objectives." The thanks of the society were extended to Dr. Blackham.

An interesting paper entitled "Notes on the Structure, Development and Position of a (supposed) Undescribed Flagellate Infusorion," was read by Mr. J. H. Fisher, of Rochester, N. Y. Mr. Fisher had prepared a number of drawings of this organism, which were exhibited, aiding materially in making his description clear to his audience.

He referred at first to the but little explored domain of animal life approaching so nearly the vegetable kingdom, and the difficulty of satisfactorily classifying and placing new forms.

The infusorion which he described, he found in a small stagnant pond near Mount Hope, Rochester, N. Y. The body of the little animal was green in color, and shaped like a cylindrical flask. The mouth resembled the neck of the flask, and had protruding from it a flagellum, presumedly used for prehensile and sustentatory purposes. The little organism was minutely described, and its life history, so far as Mr. Fisher had observed it. It was not supplied with a red eye speck. Spines were equally distributed over it, and it was thought it could not be identified with any known species. Mr. Fisher named it provisionally *Lagunicula Piscatoris.*

Mr. Lapham, of Northville, Mich., said he had seen an animacule almost identical with this, except that its outer shell was composed of successive plates. He thought it was a link between the rhizopoda and flagellata.

Mr. Wm. H. Walmsley, of Philadelphia, was the next to follow with a paper on "The Use of Wax Cells in Connection with White Zinc Cement for Fluid Mounts." He had used the method for some considerable time and it had given great satisfaction. He stated that much had been written regarding the use of wax cells for dry mounts, but that their eminent adaptability for fluid mounts had been strangely overlooked. His own use of them for this purpose had extended over a considerable period of time.

In the matter of economy, ease of preparation, and durability, he considered the method adopted of such value as to warrant his placing it before microscopic students. His chief reliance for the permanency of the cells rested upon the use of white zinc cement for coating the wax, the latter being mainly used for making the cells of various depths. Thirteen years use of the white zinc cement, during which time he had prepared thousands of slides, had satisfied him of its entire permanence, while it was the most easily used of any cement, and its appearance was elegant on a finished slide.

A ring of the cement is first made upon the slide with the turn-table. The wax ring is then added, and over the same, successive coats of the cement are applied, allowing each to dry before another is added. After the last coat has been applied and the cell allowed to dry for some time, the cement becoming hard in about a day, or even less time ; a thin coat of the cement is now applied, after which the cell is filled with the mounting fluid and the object is spread out and arranged properly in the cell. A thin glass cover must then be made to cover the cell in the usual manner, expelling the air, and it will adhere to the fresh cement all around. A spring clip is attached, the slide washed with clean water, using a camel's hair pencil, then dried with a soft towel, when, after a time another ring of the cement may be run around the cell, and the cell ornamented with colored rings. The fluids used have been glycerine both pure and diluted, carbolic acid water, and Goadby's fluid.

Mr. Walmsley submitted a number of slides for examination which had been prepared some time; they showed no signs of leakage or "running in" of the cement, and were beautiful slides in all respects.

Mr. Walmsley gave his latest improved formulæ for preparing "White Zinc Cement," which he considered an improvement on the first formulæ, which he had given to the public. He admitted in reply to a question, that in time the cement would turn yellow.

Following the discussion the society adjourned, and the members took possession of the street cars awaiting to convey them to the Museum of the Scientific Association. A pleasant hour was spent in examining the collection in the museum, which is a frame building, not very secure from fire. So valuable a collection as the Detroit Scientists have obtained should be awarded more secure quarters.

The address of President H. L. Smith was delivered at Whitney's Opera House. The evening was exceedingly oppressive, and prevented many from attending who otherwise would have been present. As it was, a fair audience greeted the Professor, and all present were amply repaid for their temporary physical discomfort in the very able address they were permitted to listen to. I regret that I am unable to give as full a synopsis of the paper as I should like, and must thank Prof. Smith for the "points," which enabled me to present the following abstract. In the publications of the Detroit meeting which it is hoped will be soon issued, the paper will be printed in full.

The address opened with a congratulation to the members of the society on the results of the former meetings—the one preliminary, at Indianapolis, and the other, considered by the Professor as really the first meeting proper of the society, at Buffalo, last year. He stated that many valuable and interesting papers had been presented at these meetings, a review of which might not be uninteresting, as also, the consideration of the optical and mechanical improvements of the microscope during the past year; but it seemed to him more proper on the present occasion to speak upon some subject with which he might be supposed to be more familiar, and that he had selected for the subject of the address, "Deep Sea Soundings, and the Relations of Deep Sea Algæ to Microscopical Life, with a Few Remarks upon Evolution." He spoke of the vast territory here opened to natural history research, and gave a very interesting description of the progress of the investigations for obtaining deep sea life, particularly those conducted by our own government on the occasion of the voyage of the U. S. steamer Tuscarora, in the Pacific Ocean. He gave a description of the apparatus used, not only for obtaining specimens from all depths, but also for determining the temperature, currents, etc. The chief portion of the address was to show that the relations existing at the surface of the earth between animal and vegetable life, the balance maintained by their mutual reactions, was equally carried out in the depths of the sea—that minute, chiefly microscopical algæ, served the purpose of eliminating the carbon from the carbonic acid existing at great depths, and restoring to the waters the oxygen necessary for vigorous and extended animal life. The Professor showed conclusively that not only the minute forms of animal life, e.g., Foraminifera, existed at greatest depths, but also radiates, echinoderms and annelids, in fact all manner of invertebrate types, and also fishes. To supply the food and oxygen necessary for such extensive life, something more than aeration by the winds and storms of the supply of organic matter dropping from the surface, appeared to be required. Many of the soundings of the Tuscarora, and also those of the Challenger, demonstrated the existence of extensive beds of "diatomaceous ooze," at great depths, and the Professor was disposed to think that to them chiefly we are to look for the means by which the water is re-oxygenated, and for the supply of vegetable food. The character of the animal and vegetable life, the close resemblance it forms to that of the cretaceous and tertiary period, was also noticed, and the bearing of the study of the minute algæ, especially upon the question of evolution. The Professor was disposed to place the origin of life in the atom itself, as an evokable property (known to us as *life*) under proper surroundings, and not merely a force called into play by some peculiar collection of atoms, whereby an ordinary chemical compound is formed. In so far as dead protoplasm is concerned, the chemical constituents, and the arrangements of the same, so far as we know, are as in living protoplasm, but where is the life? Under what conditions is this to be manifested by these atoms? Only when arranged, polarised, it may be called, for want of other terms, by pressure of other living protoplasm. The Professor stated that the atoms of steel are thus polarized and show a force not before recognized (though nothing is added), in the presence of the magnet, but they lose this power when the magnet is withdrawn. He then proceeded to show that, as in case of the steel, it is possible to prepare it, i.e.: by tempering, so that when subjected to the influence of the magnet, it does not now lose the force induced, after withdrawal of the exciting cause. So it might be possible that in the final evolution, man, while responding with every animal, and vegetable to the power of creative life, with body and soul, might, in the process of time, need or acquire that part represented by the tempered steel, and become the temple for the indwelling spirit of the Creator—and now, body, soul, and spirit. In alluding to the words of the Apostle: "We saw not this body which shall be, but another," the Professor suggested that possibly, the new form of matter which is at present, so much exciting the attention of physicists—the so-called "radiant matter," or "etherial medium" which penetrates all other matter, and all space, and is not subject to the ordinary physical and chemical laws as we now understand them, may become in the grand evolution, the spiritual body of man indestructable—and so much the more important part of man, as it is by far the most important substance in the universe. Prof. Smith closed his address with some reflections upon the character and influence of biological studies, especially as conducted by the aid of the microscope.

THURSDAY'S SESSION.

The last day's session of the society began at 10 o'clock. The name of P. L. Hatch, of Minneapolis, was recommended for membership by the Executive Committee, and he was elected.

The secretary also read a report of the Executive Committee in reference to amendments to the constitution. The amendments propose the election of honorary members ; the election of Secretary and Treasurer for three years ; making the Vice-Presidents the auditors of the Treasurer's accounts, and the Treasurer the custodian of the society's property ; making the terms of the officers begin at the conclusion of each annual meeting; and providing that if any member shall fail for two years to pay his dues, he shall forfeit his membership. The report was accepted, and the amendments will come up for action next year.

The Nominating Committee reported the following officers for the ensuing year:

President—J. D. Hyatt, President of the New York Microscopical Society.

Vice-Presidents—Dr. Geo. E. Blackham, F.R.M.S., Dunkirk, N. Y.; and W. B. Rezner, M.D., Cleveland, O.

Secretary—Prof. Albert H. Tuttle, Columbus, O.

Treasurer—Geo. E. Fell, of Buffalo, N. Y.

Executive Committee—W. H. Brearly, Detroit, Mich.; J. H. Fisher, Rochester N. Y.; and Prof. Albert H. Chester, Clinton, N. Y.

The report was adopted.

Dr. D. C. Hawxhurst, of Battle Creek, Mich., read a paper entitled, "Demonstration of the Capillary Circulation in Man." He proposed to explain a process for demonstrating the capillary circulation in man, and more particularly in the human lip. This had been done in many of the lower animals, but little success had attended the attempts to see the circulation in man. The reader did not claim any originality in the process, which was that of a German scientist. The lower lip was rolled over a support, and the lens of the microscope focalized upon the lip, which was illuminated with a powerful condensor, using either daylight or lamplight. Proper means were taken to steady and support the head, and clamps were applied to the lip to produce an engorgement of the capillary vessels. Dr. Hawxhurst stated that the power used was about fifty diameters.

The course of the blood could be seen clearly coursing through the vessels. A bit of ice applied to the surface of the lip arrested for a time the capillary flow. The speaker related many other interesting experiments, explaining the results reached by treating the lip with chloroform, ammonia, acids, glycerine, etc. The process might be used to great advantage in hospitals and in private practice to determine the condition of the corpuscles of the blood in fever, scrofula, etc.

Dr. Carl Seiler thought the powers used in this method were too low to be made useful in discovering changes in the blood corpuscles. He thought the discovery was more in the nature of a pretty experiment than anything of scientific value.

Dr. Hawxhurst thought after considerable practice results could be obtained which a novice could not discover.

Mr. Fell thought the power too low to be of practical value.

Dr. Seiler, of Philadelphia, described an improvement in a microscopic stage, which consisted of an enlarged stage arranged with mechanical movements, so that it could be made to traverse a distance of about four inches each way. The Doctor demonstrated its practical value, in exhibiting with it full transverse sections of the human vocal organs, during the meeting. He stated that at the meeting of the society last year, he set forth the necessity for certain improvements in the microscope of the future, one of which was an increased movement of the stage. Mr. Walmsley, agent for R. & J. Beck, of London, had a binocular made by that English firm, embodying the improvements suggested. Dr. Seiler exhibited the instrument, which he said was particularly valuable in examining large specimens, such as sections of tumours, the vocal organs, or anything requiring a large stage movement to bring the whole of the structure successively into view.

Mr. W. H. Bulloch, of Chicago, exhibited and described a microscope especially arranged for examining rock sections, with improved facilities for minute measurements, etc. He also described a new section cutter, devised by Prof. T. J. Burrill, of the Illinois State University. This instrument was novel in construction, and so arranged that the knife could be set at any angle with reference to the cutting surface. The "well hole" was arranged so that it could be moved bodily toward the knife blade, a large micrometer screw being conveniently arranged for this purpose.

Mr. E. H. Griffith, of Fairport, N. Y., read a paper describing the "New Griffith Club Portable Microscope." He produced a little morocco covered case, from which he took a number of disjointed parts of a microscope. These he rapidly placed together, and when the instrument was mounted the unscientific query as to how so large a microscope could be packed away in so small a box, came to the surface. The advantages of the instrument are that by a number of ingenious devices the fine and coarse adjustment, and many of the conveniences used on larger instruments can be secured, and yet when not in use it can be packed away into a very small space and carried in a cigar case or a coat pocket. The instrument was made for Mr. Griffith by the Bausch & Lomb Optical Company, of Rochester, and embodies in it several interesting points of construction, notably the fine adjustment, which is believed to be new, and is capable of being applied to larger stands.

A few words about this stand will not be out of place, and the little instrument deserves notice. Mr. Griffith, whom many of our microscopists are personally acquainted with, leads a somewhat nomadic life, and being a practical worker with the microscope, was unable to obtain an instrument embodying his ideas of a practical, portable microscope. He has at last devised one which is capable of doing more and doing it better than any *portable* microscope I have yet seen described. In ordinary use, a "turn-table" forms the base of the stand, when used as a microscope. By simply changing a few screws, and turning the instrument over, we are provided with an excellent and serviceable self-centering turn-table. For use in the field, or where a perfectly steady and stationary "stand" is required, a wood screw is provided, which may be screwed into the limb of a tree, a fence rail, or any convenient place. In this condition the highest powers of the microscope may be used. Any obliquity of illumination by the mirror may be obtained, and for opaque objects the mirror may be used above the stage as a reflector. The "nose piece" is arranged with the "Society screw," and the body tubes being telescopic, may be drawn out to the standard length of ten inches. This stand will be fully described and illustrated in the proceedings of the society.

AFTERNOON SESSION.

The first paper of the afternoon, and the last one of the session, was read by Prof. T. J. Burrill, Professor of Botany and Horticulture at the Illinois State University. It was upon "The So-called Fire Blight of the Pear and Twig Blight of the Apple Tree." His remarks, bearing as they do upon a subject of great practical interest, are given at some length.

He said the widespread and disastrous disease of the pear tree called fire blight, and that no less prevalent and alarming one known as twig blight of the apple tree, are due to the same immediate agency. They are identical in origin, and as similar in their pathological characteristics as a priori reasoning might have indicated. The quince, and probably other plants, among which may be named the butternut, the Lombardy poplar, and the American aspen, also suffer from the same disease. From descriptions it was very probable that the yellows in the peach will be found due to a similar cause. The immediate and exciting cause is a living organism producing butyric fermentation in the carbonaceous compounds, starch, etc., in the cells of the affected plants, especially in those of the bark outside of the liber. This organism, if really specifically distinct, is closely allied to the butyric vibrion of Pasteur, and the Bacillus amylobacter of Van Tieghem. The disease has been known in this country over 100 years. Various theories have been advanced and one by one disproved except the one of fungus growth. In 1878 the writer announced to the Illinois Horticultural Society the discovery of bacteria apparently connected with the disease. His investigations were carried on in an orchard where there were 94 apple trees, 20 pear trees and one quince. "After finding myriads of bacteria in the fluids of the diseased tissues," he said, "I inoculated several pear and apple trees with what to me at the time were unsatisfactory but not uninstructive results. Beginning on the first day of July, 1880, I experimented in various ways at different times upon 66 trees of the pear, apple and quince. Of the numerous applications of the virus upon the unbroken bark or leaves, none were successful. Of the inoculations there were successful 63 per cent. of the pear, 30 per cent. of the apple, and 100 per cent. of the quince. Upon the pear and quince trees used for the experiments the disease appeared only in a single case, except as the direct result of the inoculation. This latter was sometimes performed with a knife, sometimes with a needle, always with careful precautions and close subsequent examination. Such experimental limbs as permitted it were cut and preserved like herbarium specimens, and are exhibited with the paper."

The organism found answers fairly to the description of Pasteur's butyric vibrion. They are usually oblong, rounded at the ends, mostly connected two together. Their motions are not rapid, consisting of turning in every direction, and sliding irregularly forward. They are found within closed cells, in the open spaces, and in immense numbers in the viscid exudations from the diseased bark and leaves. The most conspicuous alteration observed in the tissues is the disappearance of the starch grains from the cells. The cell walls are left intact, and the protoplasmic portions remain until after the starch is mostly absorbed, and appears to suffer little change until death ensues. The disease is, par excellence, one of the bark. The leaves die in consequence of this, or are themselves invaded, either primarily or secondarily, by the destroyer. The progress of the disease is always slow, but the leaves of an affected limb often turn black quite suddenly, perhaps according to meteorologic conditions. In diseased bark, before change visible from without has taken place, and while the leaves are still green and fresh, an active fermentation occurs. This continues until desiccation or the exhaustion of the fermentable substances puts an end to the process. The products of this fermentation are carbon dioxide and butyric acid or a closely similar substance. From the fact that virus from the pear affects the apple tree, and vice versa, the speaker argued that the disease was similar in each. The experiments tended to show that the virus is harmless upon the epidermis of healthy plants, nor does it penetrate through the breathing pores. The speaker exhibited drawings of the cells of a healthy plant and a diseased one, showing that the starch in the latter was gradually absorbed. He obtained the virus from diseased trees, where it exuded, and placed it in distilled water. Upon the dead leaves and branches the virus dried and looked like varnish. When redissolved it retains its vitality. The simple puncture of the bark of a tree with a needle which had been dipped in the virus would be sufficient to cause its death. Prof. Burrill exhibited a small vial containing about a teaspoonful of the virus in solution, which he said was sufficient to destroy a whole orchard.

THE GRIFFITH AWARD.

The committee appointed to examine the specimens of adulterations of commercial articles, and to award the prize, a fine objective, offered by Prof. Griffith, for the best mounted specimens, reported that C.

M. Vorce was the only contestant and that his exhibits of coffee and butter were fine ones. He was therefore entitled to the prize.

President Smith presented it to him in a brief speech, and he accepted, regretting that there had been no other contestants.

PRINTING THE PAPERS.

The subject of publishing the papers in the microscopical journals before they appeared in the proceedings came up, and the following resolution was adopted after some discussion:

Resolved, That all papers read before the society should, if accepted by the publishing committee, be withheld by their authors from publication elsewhere until after their appearance in the proceedings; and that the committee shall be instructed to signify their acceptance or rejection at the close of each session, and shall publish the proceedings within three months after adjournment if possible.

Votes of thanks were tendered the citizens of Detroit; the members of the Griffith Club; Prof. M. H. Martin for the use of the building in which they met; Moses W. Field for the use of the steamer Grace McMillan; to the Scientific Association for the entertainment and instruction afforded at the visit of the society to their museum; to C. J. Whitney for the use of his opera house, and to all others who had contributed to their pleasure while in the city.

A resolution offered by Prof. Burrill, that the President and Vice-Presidents elect of the society be appointed a committee to report upon some plan for uniformity in size and naming of eye-pieces and tubes, was adopted.

The report of the Treasurer, Mr. Fell, showed $266.06 on hand, and $450.75 due the society, of which the Treasurer regarded $114.69 as being very certain of being paid, making the total assets $380.81. The report was adopted.

Prof. Griffith renewed his offer of a one-half inch objective or its equivalent for the best mounted slides showing adulterations in commercial articles, accompanied with the best thesis upon the specimens submitted. His offer was accepted with thanks.

The society then adjourned to meet in the evening at Merrill Hall.

The Soiree at Merrill Hall was well attended, notwithstanding the unfavorable weather which prevaled. It would be useless to attempt to give an idea of the objects exhibited or the great variety of instruments used; suffice it to say that the citizens of Detroit appeared very much satisfied with the microscopists and their exhibits on this occasion, and many expressed a desire and intention to become more interested in practical microscopy. This can be said of the soirees in which the American society has participated, viz: at Indianapolis, Buffalo and Detroit, that they have done more to awaken a general interest in microscopic work, than those of any other society yet held in this country, and as the society will continue this means of disseminating knowledge at its annual gatherings, it is hoped that their value in the future will be correspondingly great.

The following manufacturers of microscopes and accessories were represented at the Detroit meeting, by the following gentlemen, who had a complete assortment of the instruments manufactured by their several houses. Brief mention only can be given.

Mr. W. H. Bulloch, of Chicago, Ill., was on hand with a fine assortment of instruments of his own manufacture. He also exhibited the working of the new section cutter, devised by Professor Burrill.

Mr. Wm. H. Walmsley, of Philadelphia, was present with a large collection of instruments from the well-known firm of R. & J. Beck. Notably among this collection may be mentioned the large "International Binocular," which has been previously described in this journal, and also the new stand made for Dr. Carl Seiler, which we may state was manipulated by the doctor to illustrate his lately prepared sections and slides of the human vocal organs.

Mr. Edward Pennock, in charge of the microscopical department of Jas. W. Queen & Co., of Philadelphia, exhibited a varied assortment of instruments, etc., from that well-known house.

The Bausch & Lomb Optical Co., of Rochester, N. Y,, were represented by Mr. Ed. Bausch, who, in his usually agreeable manner, demonstrated the capabilities of the instruments and objectives from this enterprising firm.

Dr. Crumbaugh, of Lancaster, Pa., a member of the firm of Jno. W. Sidle & Co., exhibited the "Acme" stands, and "Congress" turn-table, prepared by this young firm. We noticed a new binocular microscope of the "Acme" pattern, which appeared a very serviceable instrument.

Mr. L. R. Sexton, of Rochester, N. Y., was another of the new faces we met with at the Detroit meeting. He represented the manufactory of Mr. E. Gundlach, of Rochester, N. Y., and had a large assortment of stands, eye-pieces, objectives, etc., of Mr. Gundlach's make.

Not only in the instruments and mechanical contrivances exhibited at the meeting of the society, was there an index of the continued advance of microscopy in the last year noticeable, but in the personal work of the members of the society a gratifying condition of affairs existed. The slides and exchanges offered at the meeting, were exceptionally fine, both in the care with which the objects were prepared and in the finish of the slides, which betoken rather the work of experienced specialists, than that of numerous workers from various sections of the country.

The Detroit meeting of the American Society of Microscopists will be noted as the third time in which microscopists from widely different sections of our land, have, under the name of a Microscopical Society, been congregated together. Who can say, in view of the number of *workers* with the microscope throughout the country, and the trifling proportion they bear in point of numbers to the population of even our *most scientific centres*, that these meetings, first, second and third, have not been successful, both in point of numbers, and in the character of the work put forth—only a small proportion of which has been made permanently accessible? Assuredly not those who were absent from a majority of these meetings, and who from the first opposed the instituting of the society on its present basis, and by their actions and conduct have been anything but *en rapport* with it ever since.

The society now numbers more active workers on its membership roll than at any previous period, and financially it is in good standing. The continued support of the microscopical workers throughout the country, who can render this support by presenting to the society the results of their labors without their personal attendance, in all cases, will, undoubtedly, make the publications of the society an index of the progress of Microscopy in America, and guarantee the future success of the society.

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— The soft mass of protoplasm or sarcode, forming the essential part of the body of all Rhizopods, has no internal cavity like the body cavity of higher animals, neither has it a mouth like the higher Protozoa, nor has it stomach or intestine. Without trace of nerve elements, and without definite, fixed organs of any kind internal or external, the Rhizopod—simplest of all animals, a mere jelly-speck—moves about with the apparent purposes of more complex creatures. It selects and swallows its appropriate food, digests it, and rejects the insoluble remains. It grows and reproduces its kind. It evolves a wonderful variety of distinctive forms, often of the utmost beauty, and, indeed, it altogether exhibits such marvelous attributes, that one is led to ask the question in what consists the superiority of animals usually regarded as much higher in the scale of life.—*Leidy in "Fresh-Water Rhizopods."*

American Association for the Advancement of Science—Sub-Section of Microscopy.

THE A. A. A. S., met in Boston on the 25th of August, and organized in Huntingdon Hall, at the Institute of Technology. The Sub-Section of Microscopy (Prof. Lattimore, of Rochester, N. Y., Chairman, and Rev. A. B. Hervey, Secretary), was to have met in the afternoon, but owing to the difficulty of getting the members together, no meeting was held. Next day, (Thursday), was spent at Cambridge, so it was not until Friday that the first meeting was held, and the following papers read:

"Microscopic Studies in Central Florida," C. C. Merriman; "The Errors of a few English, French and American Stage Micrometers," William A. Rogers; "Apparatus used in Photographing Microscopical Objects," Samuel Wells; "A New Freezing Microtome," William Hailes; "Microscopical Investigations of the Havana Yellow Fever," George M. Sternberg; "Permanent Microscopic Preparations of Amphibian Blood Corpuscles," S. H. Gage; "Permanent Microscopic Preparations of Plasmodium," S. H. Gage. The following extract from the paper of Dr. Sternberg, who is Secretary of the Havana Yellow Fever Commission, will interest our readers. The investigations were made under instructions from the National Board of Health, particularly in regard to yellow fever, its endemiscity and its germ, if any. The speaker remarked: "I think I may safely say, as the result of my investigations in Havana, that there is no gross and conspicuous germ or organism, either in the blood of yellow-fever patients or in the air of infected localities, which by its peculiar appearance or abundant presence might arrest the attention of a microscopist, and cause suspicion that it is the veritable germ of yellow fever. By gross and conspicuous germ, I mean an organism, the morphological peculiarities of which are readily made out with a first-class modern objective, such as the Zeiss 1-18, which I used in Havana. The *Bacillus anthracis* of splenic fever; the *Spirillum Obermeieri* of relapsing fever; and the bacillis of pig typhoid, or infectious pneumo-enteritis, all come under this head. Yellow fever, so far as the germ theory is concerned, may, therefore, be classed with cholera, typhoid fever, and the malarial fevers, which by a process of reasoning similar to that commonly used for yellow fever, are very generally believed to be germ diseases. While I have nothing but negative results to report, so far as the main object of my researches is concerned, I have been enabled, through the liberal policy of the National Board of Health, to study and photograph many of the common organisms found in the atmosphere of New Orleans during the absence of any epidemic disease. As I consider a thorough knowledge of these every-day organisms an essential prerequisite to an enlightened study of an infected atmosphere, I have no hesitation in calling your attention to my reports to the National Board of Health for details as to methods pursued and other matters."

On Monday the 30th, a second session was held and the following papers read:

"On the Limits of Visibility with the Microscope," by A. E. Dolbear; "Minute Anatomy of the Human Larynx," by Dr. Carl Seiler, and "Some of the Infusoria Found in Fresh Pond," Cambridge, by Prof. S. P. Sharples.

On the following evening an exhibition of microscopes and microscopic objects was held. Mr. C. C. Merriman exhibited some wonderfully beautiful specimens of *Aneimia Mexicana*, showing spore cases and pollen-like spores. These were mounted in a cell in fluid, and under the binocular, with a half-inch objective, were most beautiful objects. Almost all the other exhibitors were dealers, and we give them in alphabetical order.

The Bausch & Lomb Optical Company exhibited, under the care of Mr. Carl Lomb, a fine assortment of instruments of their manufacture, ranging from the Family microscope at $20, to the Professional at $200. The special characteristics of these microscopes are the thorough and durable manner in which they are made. The new model, known as the "Investigator's Microscope," combines, at a moderate cost, the essential points needed in the use of the modern wide-angle objectives, and their accessories. Exhibitions or "soirees" are not the place to exhibit or test the qualities of the higher class of objectives, and consequently but little was done in this direction by any exhibitor, but the objects exhibited by this firm were all shown with a clearness and sharpness that was highly satisfactory.

Messrs. R. & J. Beck, represented by their agent in this country, Mr. Walmsley, had a superb collection of instruments on exhibition, and it is hardly necessary to say that under Mr. Walmsley's management, the objects shown, and the method of showing them, were such as to gratify all lovers of the microscope. Foremost in the collection was the new stand, an illustration of which may be found in the May number of this journal. This stand, which is known as the International, is provided with all the adjustments and movements required in modern microscopical investigations. It was a source of great gratification to a large number of the younger microscopists present to be able to examine this really fine stand; the workmanship was exquisite, the design elegant, and the arrangement of the several parts very judicious. Of their smaller stands, which proceed in regular gradation from the International down to the Economic, it is unnecessary to speak, as they are sufficiently well known. The only exception to this was perhaps the new stand made especially for Dr. Carl Seiler, whose investigations on the Histology of the Larynx demand a mechanical stage of unusual range of motion.

Mr. Gundlach was well represented by Mr. L. R. Sexton, who exhibited several very neat and efficient stands, and some very excellent objectives. Among the improvements presented by Mr. Gundlach, is his new diaphragm, which can be brought close up to the slide, or removed from it at pleasure. The diaphragm plate is a section of a hollow sphere. This form has been used before for the purpose of enabling the plate to be brought near the slides, but Mr. Gundlach has mounted it in an improved manner, which adds greatly to its efficiency and convenience. To the excellence of Mr. Gundach's objectives, very strong testimony will be found in our correspondence as published in this issue.

Mr. J. T. Ogden had on hand a fine case of microscopes and their accessories, including those of most of our prominent makers. Amongst other instruments exhibited by him was the new Dissecting Microscope, just brought out by the Bausch & Lomb Optical Company. This is a very efficient, low-priced instrument, which we hope to illustrate in our next issue.

Messrs. Jas. W. Queen & Co., were represented by Mr. E. Pennock, who had a fine collection of microscopes, chiefly those of Crouch. In addition to the ordinary stands, was one small English stand by an unknown maker, which was quite portable, folding together compactly, and yet very cheap.

Mr. Schrauer, of this city, whose Physician's stands are well-known, made a very creditable display, if not in numbers, at least in the special adaptation of the instruments to the purpose for which they are intended.

Mr. Stodder had a fine exhibit of Tolles' instruments, including the new stand, (on the Tolles-Blackham model), intended for Mr. Crisp, of London. This stand was hardly finished, but it was so far completed that its fine proportions and workmanlike finish were easily seen. This was, we believe, the only stand of Mr. Tolles' make that Mr. Stodder had in his possession, and the others were kindly loaned by friends. These microscopes, therefore, showed that they had been in use, but were exceedingly interesting, as showing the development of many of Mr. Tolles' ideas. One of the famous binocular eye-pieces was also on exhibition.

Mr. Zentmayer had a very fine exhibition of microscopes, under the charge of his son, Mr. Charles Zentmayer. The instruments made by Zentmayer need no commendation at our hands, and from the Centennial stand to the little Histological, all were the admiration of every judge of good workmanship. In addition to microscopes, Mr. Zentmayer exhibited a very interesting set of apparatus for comparing the lengths of rods and bars, and especially for comparing those made as "end measures" with those used as "line measures."

Mr. Woolman, of New York, had a fine exhibition of microscopes, chiefly by Crouch. He had also on exhibition the Acme stand by Sidle & Co. This stand, as our readers know, is chiefly an embodiment of the ideas of Prof. J. E. Smith, and for the purposes for which it is intended is very efficient.

In another room, Prof. W. A. Rogers exhibited his copies of the standard metre and yard, and also his "Comparator," a microscope specially fitted up for the purpose of comparing minute spaces. Prof. Rogers explained the special features of this instrument, and while he was present his table was always surrounded with an interested and delighted audience.

Mr. Wells exhibited some very fine photographs of microscopic objects, the process for producing which he had previously read before the Sub-Section.

The next meeting of the Association will be held at Cincinnati. The officers elect of the Sub-Section of Microscopy are as follows: Chairman, Rev. A. B. Hervey; Secretary, Prof. S. P. Sharples.

The Detection of Forgeries by the Microscope.

A paper read by Prof. J. H. Wythe, A.M., M.D., before the San Francisco Microscopical Society.

AN article in the *Banker's Magazine* for August, 1878, refers to the value of the compound microscope in the examination of handwriting, beyond the ordinary methods of experts who rely upon unaided vision or a hand-lens. It shows that the conclusions of an ordinary expert are reliable just so far as they rest upon data which can be explained, and no farther. A man who writes his signature frequently falls into a series of rhythmical movements which are peculiar to himself. This may arise from habit, or individuality of muscular organization. His general handwriting may differ in style from his signature, but the accentuation remains the same. A talented imitator may produce this general rhythm of a signature, and cause the testimony of an expert to become vague and uncertain. The expert may detect a difference, empirically, but he is unable to explain it to the satisfaction of a jury. "It is just at this point" says the writer, quoting from a letter to the New York *Times*, "where the methods of the expert break down, that the more delicate methods of optical analysis represented by the compound microscope, interpose to detect and demonstrate forgery." In addition to the larger rhythm upon which the expert bases his judgment, there is a minute secondary rhythm caused by the action of the small muscles in regulating the amount of pressure upon the pen, which is imperceptible to the naked eye, and cannot be accurately determined with a simple magnifier, but which is easily discerned in a compound instrument under a power of about ten diameters, if the writing is strongly illuminated with a good bull's-eye condensing lens. These variations of pressure are between 200 and 300 to the inch, and are as regular in proportion, as they are spontaneous and involuntary. When a man writes naturally, the pressure variations are rhythmical, while on the contrary, when he is consciously imitating the writing of another, they are irregular and unsymmetrical. No matter how cleverly a signature may be imitated. So long as the writer exercises the voluntary control of the hand, which is essential to the act of imitation, just so long the margin of the stroke can be demonstrated optically to be irregular in the length and the distribution of the waves which indicate the muscular impulses. Thus the compound microscope determines the issue at the point where the coarser processes of the ordinary expert fail. My attention having been called to this subject, I instituted numerous experiments, which have convinced me of the general accuracy of the article, of which the foregoing is an abridgement. Careful investigation enables me to classify the phenomena of hand writing, especially signatures, as analyzed by the compound microscope, as follows:

1. The rhythm of form, dependent on habit or individual organization. This is the main dependence of the ordinary expert. It may be determined by the naked eye or a hand-lens, but is still more easily seen by means of the magnified image in the compound microscope. In some cases, an enlarged photograph of genuine and disputed signatures may be useful—remembering, however, that the form of letters may change, from time to time, more readily than the general rhythm.

2. The rhythm of progress. This is the involuntary rhythm, referred to above as pressure variations on the point of the pen, and seen as a wavy margin to the letters of signature when well illuminated on the stage of the compound microscope. It is caused, in all probability, by the rapidly successive nerve impulses upon which the contraction of the muscles depend. In age or infirmity, these impulses are perceptible to the eye, and we say that the hand trembles. "But as a matter of microscopic analysis the hand always trembles, and it is an inalienable property of muscular contraction that it should." The regularity of this rhythm is destroyed by a voluntary effort at imitation, and is somewhat interfered with, but not entirely broken, by mental excitement. This rhythm differs in different hand-writings, so that it is well for the examiner, if practicable, to accustom himself to the habitual rhythm of a genuine signature before expressing a judgment on one which is questioned.

The art of writing, is a most complicated one, requiring the consentaneous action of many muscles. When perfectly performed it should be nearly, if not quite, automatic, requiring very little mental stimulus for its performance. If any act which should be automatic, demands our attention in order to execute it, the difficulty of performance increases. The ordinary mental stimulus suffers an emotional diversion, which causes proportional muscular impotence. Hence emotional disturbance causes a trembling handwriting. In cases of writers' cramp, in which the muscles respond but sluggishly to the will, and render the grasp of the pen faltering and uncertain, this rhythm is greatly exaggerated or interrupted. Paralyses of the ulnar nerve, rheumatism of the shoulder or wrist, neuralgia and alcoholism, may also interfere with the rhythm of progress. But in no case is the failure of the rhythm so marked as in a voluntary attempt at imitation.

3. The rhythm of pressure. By this I mean, not the involuntary and rapid action of the muscles, producing a microscopic wave as the writing progresses, but a rhythmical alternation of light and dark strokes, which is characteristic of some signatures, and which, in all probability, is a variety of the rhythm of form; yet, as it is revealed to microscopic analysis rather than to ordinary vision, it may escape the most expert imitator, and so become another factor in making up a judgment in any case.

If the microscopist carefully observes these three rhythms, being careful of the illumination of the letters, he cannot fail to demonstrate the difference between a genuine and an imitated signature.

In a recent trial before Judge Crane, in Oakland, I was able to discriminate between imitated and genuine signatures in a large number of cases of remarkable similarity, prepared by a most talented writer, as well as to testify to the genuineness of signatures in which there was considerable variation of form. Mr. Geo. C. Hickox, also a member of the Microscopical Society, and well known as an expert in such matters, when his attention was called to this use of the compound microscope, declared to the Court that it was a new and wonderful revelation, fixing beyond question the individuality of hand-writing, especially of signatures.

Should this method of investigation be much used, as it ought to be, it would be convenient to have a microscope made for the purpose, having a large stage with clips so as to hold paper of considerable width, a tube of wide diameter to collect as much light as possible, a very low power eyepiece, and a special objective of long focus and large field of view.

Pelomyxa Palustris.

(Continued from page 202.)

SOME months ago, I mounted a large opaque Pelomyxa under cover glass in water. It was of irregular shape, a thing not very common in my experience, as by far the greater number of examples are of an ovoid shape, and scarcely ever change it materially. The shape under observation is correctly enough shown in Fig. 3, as to the outline in ordinary optical section. Two short lobose pseudopodia are seen at upper right and left hand corners, and one at lower right hand corner. These pseudepodia *a*, *b*, *c*, were simply extensions or bulgings out of the body, nowhere hyaline, and in them was plainly to be seen the same sort of granular circulation as always occurs in such pseudopodia, in Pelomyxa, and as I had often before observed, so that there was no sign of their being different in character, and, therefore, not the least expectation on my part of witnessing any extraordinary phenomenon. It being necessary for me to discontinue the observation for about half an hour, I took pains to leave a plentiful supply of water to guard against much increase of pressure. On my return, I was much astonished to see a form entirely different from any ever before met with. The pseudopodium, *a*, had travelled away from parent mass, having gathered itself together into an egg-shape, from the smaller end of which there ran a hyaline thread of protoplasm, (Fig. 4), connecting it with the parent mass. I had not long to wait, and the thread, *d*, suddenly parted at its weakest point, *a* having, in the mean time, continued to travel directly away from the parent mass, and as constantly stretching the thread, which, after breaking, was retracted, one-half into the parent mass, the other into the body of the now independent Pelomyxa, *a*. After separation, the young P. moved rapidly away in a pretty constant direction, scarcely changing its shape.

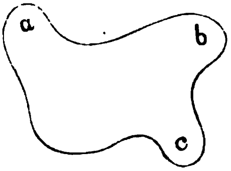


Fig. 3.

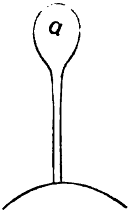


Fig. 4.

Turning now to the upper right hand corner, I saw what appeared to be an earlier stage of this same "mode of reproduction." The pseudopodium, *b*, which at first was an ordinary blunt protuberance, now showed a deep constriction near its base, Fig. 5. This constriction grew gradually more marked, while the pseudopodium rapidly assumed more and more the character of an individual. This appearance of individuality became very evident some time before actual separation, the pseudopodium, or rather its extremity, moving away precisely as travels a small Pelomyxa, the connecting

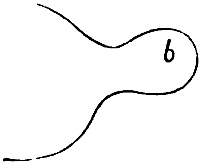


Fig. 5.

cord meanwhile growing longer and smaller, until it breaks at its weakest point.

In this manner I saw the birth of six young P.'s from one fair sized individual. The young P.'s so produced measured in length ·14 mm., ·23 mm., ·40 mm., ·45 mm., ·54 mm., ·60 mm., the parent mass being reduced to ·90 mm.

These resultant forms I kept under observation for some hours, at the end of which time they appeared in every respect as at first, so that I am inclined to think that we have here a normal process of reproduction.

W. G. Lapaam.

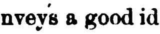
A New Cell for Opaque Objects.

THERE has just been placed in our hands a circular relating to a new cell recently devised by Mr. H. F. Atwood, of Rochester, N. Y., who has placed them on the market. The accompanying sectional view conveys a good idea of its shape the dotted lines indicating the thin glass cover.

Speaking of this cell Mr. Atwood says:

"A considerable experience in mounting opaque slides during the past few years has convinced me that much of the labor incident to it could be avoided, if a cell of suitable material and shape could be produced at a nominal cost. This, I think, has now been attained, and I take pleasure in submitting one for which I claim convenience, cheapness, and general utility. With it the amateur can produce a slide fully as perfect, and with as great a degree of neatness as can the professional. The cell is of hard rubber, highly polished, and of attractive shape; the base is solid, thus giving a black back-ground of rubber; around the top is a ledge fitted to receive a one-half inch cover glass; this being secured by a trifle of shellac or any similar cement, completes the mounting. The cell may be attached to a glass slip by any cement, before or after preparation. For exchanges it offers superior advantages, inasmuch as the cell, with objects enclosed, may be sent through the mails independent of the glass slips, the recipient attaching them. In this way a saving is made in postage, and no risk of loss by slips being broken in transit.

They will solve the problem which often perplexes the student or collector who is crowded for cabinet room. many objects for future reference may be mounted in this simple cell, numbered and put away without a slide, a cabinet drawer holding two hundred of them, while but forty slides could be accommodated in the same space."



CELL FOR OPAQUE OBJECTS.

The cost of these cells is thirty cents per dozen.

◆

The Micrococcus of Bluish Pus.

The following note we clip from the Buffalo *Medical Journal*, for which it was translated from the Dutch by P. W. Van Peyma, M.D.

As is well known, a controversy has long existed between Cohn, on the one hand, and Billroth and Naegele on the other, over the question whether, in the case of the Schizomycetes, there exist as many distinct species as variations in form; or whether the various forms are capable of transition into each other, thus proving the existence of but one, or at least of but very few species. This controversy is being vigorously pushed by Cohn, and he has mentioned the micrococcus prodigiosus and luteus as examples whose form and color are permanently maintained, no matter how the coccus is propagated. He adds that if by propagation other varieties develop they must be considered as arising, not from the micrococcus prodigiosus or luteus, but rather as having a foreign source; should, however, cocci of similar forms and color appear, this is to be considered as conclusive proof of the stability of the various forms of Schizomycetes. Strange as it may seem this argument has been allowed to have force with even some quite intelligent persons. Some experiments tending to answer this question have been made by Dr. Kurlich's in Langenbeck's Archives in an article entitled, "Ueber Vegetation von Pigment Bacterian in Verbandstoffen."

The investigations seem to have been made under the supervision of Prof. Von Bergman, of Wurzburg, who is well known as having written upon this and similar subjects. The investigations were limited to the varieties of coccus found in bluish pus. The cocci are recognizable by a peculiar aromatic sweetish odor. Von Bergman recognized this odor in the sputa of a patient with pulmonary gangrene. The colorless coccus inoculated upon purulent granulations caused bluish pus. As the result of a gunshot wound, a patient had a pus-secreting wound of the tongue and lower maxillary; the secretion, not bluish, had the peculiar odor, and by inoculation upon a purulent granulating surface, the blue pus cocci were formed.

The color and nature of the cocci have, therefore, but an indirect connection with each other. This is further shown by the fact that these cocci can be made to increase in Pasteur's fluid. They are here entirely colorless, but can be made to assume the blue color upon mixing with pus. The yellow cocci, which in Wurzburg is often found upon moistened bread exposed to the air, when added to pus, were transformed into the blue variety. The blue pus cocci, the yellow cocci of bread, the colorless offspring of the blue cocci in the fluid of Pasteur, when implanted upon gypsum produce red cocci. Still, in other ways was it determined that the color is really of no moment to the cocci. Cohn would thus appear to have no reason for distinguishing the colored cocci from the colorless. In no instance does it seem warranted to classify according to color.

* * *

Gutta Percha Cells.

My attention was first called to this method by Dr. Tulk, of London, who suggested for this purpose the thin gutta-percha tissue, used by surgeons in the place of oiled silk. I have had special punches made, which cut neat rings from this tissue, and I have used these rings with the greatest satisfaction. I have no preparations of my own more than about two years old; these so far, show no signs of change. Dr. Tulk informs me that he has them ten years old, and still good as when new. I have noticed that in some recent papers in the microscopical journals the writers, who with little experience, have so lauded wax rings, speak of "thin rubber" for rings. Evidently they have seen somewhere the gutta-percha mount, and supposed it rubber—the latter will not answer, melted rubber will not become hard. One beauty of the gutta percha ring is the very moderate heat required; it is thus available for many objects which might be injured by the greater heat necessary for the asphalt or shellac rings. As these rings in the arrangement which I have spoken of, can be rapidly made, and as they can be kept for any length of time (shut away from the dust), they are at any moment ready as well as convenient for use. The preparation is first arranged, dried or burnt on the cover, the slide cleaned, a ring laid on the centre and on this the cover is placed; the whole is now held together by the forceps, and *slightly* warmed, just sufficient to soften the gutta percha; the forceps may now be laid aside, or used simply to press the cover home, warming the slide gently, also the cover; the perfect contact of the softened "tissue" with the cover and slide is easily recognized, and with a little care this can be effected very quickly, and nothing further is necessary. A finishing ring of colored cement makes a very neat mount, but it is not necessary.—*Prof. H. L. Smith in Science.*

[We have no faith in the durability of gutta-percha. Every specimen that we have had an opportunity of watching, has become granular and brittle after a time. The finishing ring of cement which Prof. Smith regards as unnecessary, we consider the salvation of these cells. The gutta percha ring, if unprotected, will, after a time, become a mere mass of loosely adherent grains. If, however, these grains be held together with shellac or some other varnish or cement, the cell may last a long time.—Ed. Am. Jour. of Microscopy.]

* * *

Current Notes.

Astronomy in Rochester.—The new Warner Observatory, which is being erected at Rochester, N. Y., is attracting much attention in social and literary as well as scientific circles. The new telescope will be twenty-two feet in length, and its lens sixteen inches in diameter, thus making it third in size of any instrument heretofore manufactured, while the dome of the Observatory is to have some new appliances for specially observing certain portions of the heavens. It is to be the finest private observatory in the world, and has been heavily endowed by Mr. H. H. Warner. Professor Swift has labored under numerous disadvantages in the past, and the new comet which he recently found was in spite of many obstacles, but as the new institution is to be specially devoted to discoveries, there are good reasons to expect very many scientific revelations in the near future from the Warner Observatory at Rochester.

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The American Society of Microscopists.

IT is with great pleasure that we give our readers this month a very full report of the Proceedings of the American Society of Microscopists. This, as our readers know, is a young society, and yet it shows a degree of vigor and *esprit de corps* which cannot fail to secure success. Notwithstanding drawbacks which would have utterly paralysed a less energetic society, its meeting at Detroit was a success, both as regards the number of members present and the character of its transactions, and we feel confident that in future it will grow rapidly in strength and in usefulness. To do this, however, it must maintain a separate and distinct organization, and although it may be in bad taste for us to criticise the labors of a meeting at which, unfortunately for ourselves, we were not present, yet we cannot help expressing the feeling that the present method of publishing the Transactions is a mistake. The Transactions should be published in the same way as those of the A. A. A. S., the R. M. S., the R. S., and other prominent societies. Every member should be entitled to a copy, and very little reliance should be placed upon the receipts from sales to outsiders. If the present membership fee is not sufficient to do this, then let it be increased by half a dollar—the present price of the Transactions. This would do away with all necessity for such a resolution as that which disfigures the transactions of this year, and which prohibits the members from publishing their papers elsewhere until after they have appeared in the Proceedings. Such a course tends to no good. The papers read before this society relate to widely different subjects; some pertain to zoology, some to botany, some to mineralogy, some to microscopy proper. The credit and usefulness of the society is increased by having these papers appear, and appear promptly, in special journals all over the world, and anything which prevents this universal publication, detracts in several ways from the success of the society and its work. First of all, it is opposed to the very objects and purposes of the society, which is to diffuse knowledge, and not to sell transactions. Secondly, it prevents the presentation of special papers, and so works direct evil to the society. The man who gets up a paper upon some special subject in Zoology, wants all the Zoologists in the world to see it. The only way to bring it before his fellow Zoologists is to publish it in a Zoological journal, or as a separate monograph. Anything in the by-laws which prevents his doing this widely and promptly, will tend to prevent him from bringing the paper before the society. Moreover, it will be found that in many cases such a by-law is inoperative, and this year we have the curious spectacle of a paper read first before the American Society of Microscopists, then before another society, and finally, published *in extenso*. Moreover, the publication of separate papers detracts very little from the value of the proceedings as a whole.

We trust that at the next meeting this will be "reformed altogether." As was said of old: "The liberal heart deviseth liberal things, and by liberal things shall he thrive."

The American Society for the Advancement of Science.

THE meeting recently held in Boston by this body was undoubtedly the most successful in the history of the Association. The proportion of members present was greatly in excess of that at any former meeting; the number of new members added was something unprecedented; and more important than all, the papers read were of great interest and value. When to this we add the munificent hospitality of the citizens of Boston, who did everything that lay in their power to render the sojourn of the members pleasant and profitable. it may readily be supposed that this meeting threw all former ones in the shade, and this was the universal verdict of the members.

But for the special department which most interests the readers of this journal—the Sub-Section of Microscopy—we cannot assert the same success. Notwithstanding the earnest and judicious efforts of the chairman, Prof. Lattimore, of Rochester, N. Y., the meetings of the Sub-Section were few and far between, and the interest of those microscopists who were present, seemed to be attracted in other directions. At the exhibition on the last evening on which the Sub-Section met, there were but two or three private exhibitors, and to our personal knowledge several members who brought instruments and objects, did not think it worth while to unpack and exhibit them.

This is not to be wondered at, however. The Sub-Section of Microscopy has never been a success in the A. A. A. S., notwithstanding all that has been done to establish and foster it. What the *reason* of this is, we do not now care to discuss; it is sufficient for our purpose that the facts, as recorded in the Proceedings of the Society, abundantly sustain our position. Turning back to previous years, we find that at the meeting at Troy, N. Y., quite an interest was excited in the subject, mainly through the efforts of Dr. Ward, and the Rev. A. B. Hervey. At the meeting at Buffalo, in 1876, this interest culminated in the founding of the Permanent Sub-Section, with Dr. Ward as Chairman. At the Buffalo meeting many of our best microscopists were present, notably Prof. H. L. Smith, Prof. Morley, Rev. Mr. Hervey, Prof. Tuttle, C. A. Spencer, E. Gundlach, and others. Several very valuable papers were read, and a most interesting conversazione and exhibition was held in the Grosvenor Library. On turning to the published proceedings of that year, however, it will be found that not a single paper from this Sub-Section was published, and in the report of the Secretary, while everything else has a place, the meeting at the Grosvenor Library is not so much as mentioned!

The same thing occurs in subsequent volumes. In the vols. for 1877, 1878 and 1879, the work of the Sub-Section is passed over with the merest mention. At every meeting, the microscopists connected with the association make a spasmodic effort to establish a Sub-Section, and make a beginning. Thus far, their labors have resembled those of Sysiphus—as fast as they have rolled the stone up the mountain, it has rolled back again. For ourselves, in view of the efforts of the competent men who have tried and failed, we have no hope of ever seeing this department of the A. A. A. S., made a success.

* * *

Our Book Table.

The Microscopist: A Manual of Microscopy and Compendium of the Microscopic Sciences; Micro-Mineralogy, Micro-Chemistry, Biology, Histology and Practical Medicine. Fourth edition, greatly enlarged, with two hundred and fifty illustrations. By J. H. Wythe, A.M., M.D., Professor of Microscopy and Histology in the Medical College of the Pacific, San Francisco, Cal. $5. Philadelphia: Lindsay & Blackiston.

This work forms a large handsome volume of over 400 pages. It is by far the largest and most expensive work on the microscope thus far issued by an American author, and it was with a sincere hope that the new edition would not only do credit to us, but place within the reach of American students an exhaustive treatise on the microscope as it is, that we took it up for review. After a most careful examination, we have to confess that we are completely disappointed.

In regard to all those points which specially interest the modern student, the work is a quarter of a century behind the times; the subjects to which the earnest student will be most likely to turn, are treated in the most cursory manner, and the information that is given is entirely obsolete. This is a hard verdict, and one which we reached with great regret; but we do not believe that there is a single intelligent microscopist in the country that will not agree with us. At the same time, however, we must acknowledge that every review of the work that has come under our notice has been most favorable, and therefore, in view of the universal praise, which has been accorded to the book by the journals of this country, it is proper that we should give our reasons for dissenting from the general opinion.

In forming an opinion of the merits of any book, it is necessary to take into consideration the aim of the writer, if we can get at it. Fortunately for us, Prof. Wythe tells us (page 20) that, "it is proposed to give such a *resume* of microscopy as shall enable the student in any department to pursue original investigations with a general knowledge of what has been accomplished by others." We are not dealing with an elementary primer, therefore, but with an advanced treatise which ought to present to us the general condition of microscopical science in the year 1880. When we examine the pages of the book, and find that the author proposes to do this in 434 pages, each containing less than half as much matter as a page of Carpenter's work on the microscope, we are astonished at the author's powers of condensation, for Carpenter, who does not touch at all upon several subjects treated of in this book, has filled 848 pages (equal to 1,600 pages of Wythe's volume) in an attempt to do the same thing!!

More careful examination shows us, however, that what we suppose to be condensation is merely omission, and that quite a number of important subjects are either entirely omitted or merely mentioned. Thus the subject of objectives occupies just one page, with three additional pages on test objects a little further on. Wenham's reflex illuminator is dismissed in two lines; Smith's vertical illuminator has just six lines, and in neither case does the author give any directions for using these important accessories.

The section on object glasses is worth quoting, and as it is not very long, we here reproduce it. After referring to the usual diagram, telling us that there are three lenses, each composed of a double convex of crown glass, and a plano-concave of flint, the author goes on to say:

> "Different opticians have different formulæ, and propose various arrangements of lenses, and there is room for choice among the multitude of microscopes presented for sale. For high powers, the German and French opticians have lately proposed a principle of construction which is known as the immersion system. It consists in the interposition of a drop of water between the front lens of the objective and the covering glass over the object. This form of object-glass is coming into general use. For the more perfect performance of an objective, it is necessary that it should be arranged for correcting the effect of different thicknesses of covering glass. This is accomplished by a fine screw movement, which brings the front pair of lenses nearer or further from the object. In this way the most distinct and accurate view of an object may be obtained."

Comment is unnecessary. To be gravely told that water-immersion objectives are "coming into general use," just as they are giving way to the homogeneous lenses, is decidedly rich.

After this, we are not surprised to find Gundlach still located in Berlin, (page 27), or to be told that Dr. Woodward has resolved *Amphipleura pellucida*, "with Powell & Lealand's 1-16 immersion, using oblique sunlight through a solution of ammonio-sulphate of copper," and that no glass has ever revealed the lines on Nobert's 19-band plate, though "it is said that Hartnack's immersion system No. 10, and oblique light has resolved the lines in the 15th band," (page 56).

These are not isolated examples of the character of the book, and we submit that they fully justify the verdict which we have pronounced.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

"Honor Claimed Without Service Rendered."

Ed. Am. Jour. Microscopy—I copy the above heading to Mr. Bragdon's letter in your last issue, because it is typical of what follows. Except in acknowledging "indignation" and "resentment," his writings, and Mr. Stodder's, are to the same effect, and one reply will serve for both. Mr. Bragdon must have spent days in wading through all that I have written on this subject since 1855, when only dry objectives were known. Sensible persons will say that he might have spent his time to better purpose. It is the same eternal repetition of what has, or has not been said, over and over again. This has become disgusting to every dispassionate microscopist, and I shall not, therefore, waste time even to turn over a leaf to refer to the items of a mere personal past controversy. I only notice the misstatements contained in Mr. Bragdon's letter. My paper appearing in the *Journal of the Royal Microscopical Society* for Dec., 1879, was written in consequence of Mr. Stephenson's misplaced strictures previously read before the society. My paper consisted of quotations, and I carefully avoided anything that might appear personal, and in this I was kindly aided by the honorary secretary and editor, and it was understood that this was to be the last to be written on the aperture controversy in this country. Mr. Stodder, however, took umbrage, and answered it four months afterwards in his usual style.

I said in my last letter to this journal, that my claim to the added front might be taken as "an inference of plagiarism against Mr. Tolles." Mr. Bragdon carries the "inference" a little further than this, and alleges that "I accuse Mr. Tolles of stealing my ideas," adding "another insinuation of theft," and that I state "twenty years afterwards Mr. Tolles stole the idea from my paper." This language needs no comment from me. Mr. Tolles may not have read my paper of 1855 "till recently," and I, therefore, accept the explanation. If it was not read by him sooner, it is no fault of mine, as I have repeatedly referred to it for years past in the controversy, in which it has been persistently ignored till now, when some notice must be taken of it. I will at once dismiss the portion of Mr. Bragdon's letter filling the whole of pages 181 and 182, concerning this objective, because he knows nothing of the subject that he is writing about.

I still have this 1-5th with the supplemented front. In fact I possess no other—it belongs to the series of my microscope, and has not been altered since 1855. It is, and always has been, a *success*, and embodies all the conditions of balsam aperture that I have specified. With the supplemented front, it readily and distincly displays the markings on *Amphipleura*. This was recently shown with perfect candor, and fairness, in the presence of others, by one that in this country has been my greatest opponent in the aperture question, which is now, however, very properly tabooed between us. Two more 1-5ths of this same construction, acting either with or without the supplemented lens, were exhibited at the Philadelphia exhibition, but as they have been sold long ago, I cannot lay my hands on them. Yet Mr. Bragdon, without having seen anything, would persuade the public that my aperture was limited to 82°, and that the arrangement is a "failure!" I do not, however, come forward to recommend it, for I *have* "abandoned it," and I think it is a pity that Mr. Tolles does not do likewise, because an assimilation to this formula, necessitates very small front lenses, which are objectionable. Other makers succeed in obtaining the extremes of aperture, in either oil or water immersion objectives, having remarkably large fronts.

I have now to refute the next accusation: I do not, either privately or in public, put myself, forward as the first inventor of the "homogeneous" objectives. As a matter of right, I simply desired to have former sentences of my own recorded, just as published, in which I made suggestions descriptive of the conditions of an homogeneous immersion lens. This called forth the ire and at the *same time* some written comments, by the then claimant, on my paper (not yet read,) who, for this, my offence, raked up against me what he considered to be the sins of the *aperture* question, a matter that had nothing to do with the subject of my record. As I am not without friends in the society, something like a scene was the consequence. If Mr. Bragdon thinks that Mr. Tolles has the best right to the oil immersion system, he is welcome to bring the claim forward in his favor, without contradiction from me; there is this difference:—Mr. Tolles has given us formulæ for objectives—which he is competent to do—Mr. Stephenson has done nothing of the kind.

I am not so "shrouded in a thick cloak of egotism," as to be unable to see that I am unpopular amongst certain microscopists, or to imagine that my "claims and hints radiate a crown of diadems about my brow." Even if the nature of the subject admitted such an exalted state of things, as this quaint expression implies. I am pretty conscious of getting latterly but small praise and plenty of abuse, from the said clique, who are disposed and ever vigilant to hail any fresh appearance with hoots and hisses. I need not specify names—they have well advertised themselves.

Though Mr. Tolles' name necessarily appears in the question, I am sorry if anything that I have said may tend to injure him, as he indeed needs sympathy for his certain sacrifice of health and rest in his pursuit. He is not the only maker of object glasses that needs sympathy—it is an occupation teeming with many vexations; one that ties up a man in life, and by which he cannot acquire wealth, and must die poor.

Having thus briefly noticed the points contained in the letters of Messrs. Stodder and Bragdon, I remark that there is not one man of any note as a microscopist, that condescends to make these attacks. They are raised by a few narrow-minded individuals, incapable of expounding the science of the question, who seek to form a kind of tribunal on my actions and conduct; and virtuously express "spontaneous feelings of indignation." Ditto "of resentment" at the "egotism," "unjust insinuations" "plagiarism," "misrepresentations," or implied falsehood, which they attempt to show, have ever been the accompaniments of my walk in microscopic science. All this is really too ridiculous, and if one of them could only *hear* a little of what is said around him, it might improve his moral perceptions. No one has a higher appreciation of the beautiful workmanship of Mr. Tolles than myself, who, by his own publications can claim his just dues, but appearing in a personal controversy, in which he takes no part, he may well exclaim "save me from my friends!"

Finally I state that the aperture question is by no means "now settled," as some so complacently assert; it may be, perhaps, in the next generation. As the principal writer, holding opposition views, I have been simply crowded out at last—even learned professors have appeared in the field against me, but whatever their other qualifications may be, I have shown that I hold but little respect for their opinion in this matter. The following conditions have yet to be disproved before the present modes of measurement can be admitted as correct:

1st. Half of object glass, though it covers nearly the entire field, measures more than the half angle of aperture.

2nd. Triangle of focal distance taken either in water or air, up to working diameter of front lens, does not correspond with the angle taken by the usual methods of measurement.

3rd. Angles taken from the limit of a small stop on front lens, up to focal point, representing the true aperture under the circumstances, is shown in excess by the usual modes of measurement.

4th. As the converse of this, if an opaque patch is placed on the front of the object-glass, so as just to obscure an object in the centre of the field, surrounding objects are, nevertheless, visible. The true angle of aperture is from a point in the focus up to the margin of this stop. Outer rays extending and measured beyond this angle, comprise the angle of field. This is Prof. H. L. Smith's "ink spot" experiment.

F. H. Wenham.

Penetration.

Ed. Am. Jour. Microscopy—Although my townsman, Prof. J. E. Smith, has "assumed the pressure" on the subject of "penetration," I do not see that he has adduced any new argument on the question at issue, which is, whether penetration as a quality in objectives is always a defect. When, in my former communication, I spoke of Dr. Blackham's "perfect objective," I referred to a theoretically perfect objective, according to his view, that is, one absolutely without penetration. But I am surprised to see Prof. Smith declare that Dr. Blackham's 1 inch is "superior" in penetration, while Dr. B. says it has very little of it!

Suppose the field glass first used in Professor Smith's first experiment will show when focussed on (*b*), all the three houses plainly and clearly in their natural relation to each other and to all surrounding objects, and will enable the boy to even count the nail heads on the side of (*b*), and show at the same time all the details of (*a*) and (*c*), except the nail heads, which to be seen must be focussed for separately on each house; while the second field glass will even disclose the rust on the nail heads of either house, but *will show nothing else of the house or anything else at the same view.* Which field glass is capable of the most general usefulness? With which can one soonest explore and inspect an expanse of country?

Experiment No. 2 cited by Prof. Smith, is simply threadbare. Nobody doubts the superiority of wide angles over narrow ones in most respects. I have repeated this "experiment" times without number. I have even used a very wide angled 3 inch objective with ⅛th inch solid eye-piece, but all these experiments, and all the experience I have been able to get out of some years of work, have served to confirm my dislike of eye-piece magnification. I cannot see an object the same, nor as well, with a low objective and a high ocular, as I can with a high power wide angled objective and a low eye-piece, and if the objective, in addition to good definition, has good penetration, it suits me all the better.

In actual practice, it is tempting, on account of its ease, to gain power by eye-piecing up. I often do it myself, but invariably, when I have thus gained the power, and seek to settle some doubt by it, I feel impelled to try a higher objective, and go back to a lower ocular, and invariably when I do so, I feel well repaid for the trouble of the change by a far superior result.

"Mere definition of surface," in my former article, did not refer to opaque objects *alone.* I like the vertical illuminator, and it is one of my most valued accessories, but its penetration is precisely that of the objective which projects the light upon or into the object. It is not necessary to resort to this accessory to show an apparent (possibly real) nucleus in blood corpuscles. Manipulation of the light will do it by transmitted light.

Prof. Smith's quotation from Stricker expresses my view exactly. I believe in precisely that method of work, viz: begin with penetration and finish with definition. But, after all, I fail to find any error of the older histologists pointed out by Prof. Smith. No one doubts, or ever did doubt, so far as I know, that with improved objectives *new discoveries* would be made, but the broad assertion was that the older histological work was not only *incomplete*, but *erroneous*, and by some, at least, holding this view, it was attributed squarely to the use of lenses possessed of that much abhorred penetration. Now, I fail to see it pointed out where any of the work that the older histologists *did* do was wrongly done. No one knows better than Prof. Smith, that I am but little acquainted with histology, hence, his inviting me in the very scant time I get from my business to read up the work of several men's lifetimes, and hunt out some error, instead of pointing me directly to some of the errors, if any exist, seems to me like begging the question entirely.

I doubt not that errors exist in the work of both the old and the new histologists. It could scarcely be human work if otherwise. But the point is, were such errors due to faulty *observation* caused by defective image, owing to low angle of objective used, or were they errors of *interpretation* due to faulty reasoning regarding what was correctly shown?

Prof. Smith cannot be serious in asking me to publish abroad the names of persons claimed to be mistaken in their views and observations, which would simply be to embark on a stormy sea of dispute and public controversy, for which I have next to no time and still less taste. Especially, since he first charged error, should he first produce some proof of it. If he really asks for information, he meets me almost daily, and can obtain it privately at any time.

The original question was the defect *per se* of penetration in objectives. My views on the subject were expressed very fully in the paper read by me before the American Society of Microscopists, at Detroit, in August last, and I can add nothing to the argument therein contained, and shall, therefore, now retire from the discussion, and leave the subject to the penetration of every microscopist's judgment on its own merits. C. M. VORCE.

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The Diagnosis of Blood Stains.

Ed. Am. Jour. Microscopy—I observed in the September number of your excellent journal, a letter from Richard H. Lemmon, M.D., which strangely misrepresents my position in regard to the "Diagnosis of Blood Stains by Microscopic Examination."

Putting aside the more obvious interpretation of my assailant's note, and charitably attributing it to simple lack of knowledge, or congenital deficiency in mental acuteness, I beg leave to reply with the following quotations from my paper in the *London Monthly Microscopical Journal*, May, 1875, p, 215: "As far as I am aware, there is at present, (1875,) no method known to science for discriminating, microscopically or otherwise, the dried blood of a human being from that of a dog, monkey, rabbit, musk-rat, elephant, lion, whale, seal, or in fact any animal, whose corpuscles measure more than 1-4000th of an inch in diameter;" *but* (p. 213,) "as may often happen in medico-legal practice, *when evidence other than microscopical*, narrows down the conditions of the case, to the question: 'Is this stain human blood, or that of an ox, pig, or sheep?' the microscopist can, from fair specimens of blood spots, as ordinarily produced, affirm truthfully, that the given stain is positively composed of human blood, should it really be so."

These statements, (which, by the way express my present views), published more than five years since, in the organ of the British Microscopical Society, and a little more briefly, in the leading medical journal of America, (*Am. Jour. Med. Sciences*, April, 1875, p. 576 , could, it seems to me, with difficulty elude a truly earnest student of this important problem in medical jurisprudence, and I must, therefore, apologize for occupying your valuable space with them, at this late period of the controversy.

JOS. G. RICHARDSON.

Philadelphia, Oct. 6 1880.

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Blood Corpuscles in Medical Jurisprudence.

Ed. Am. Jour. Microscopy—In your Sept. issue, p. 207, there appeared a letter on Blood Corpuscles in Medical Jurisprudence, which seems to show a misapprehension of the position taken by at least one of the persons criticised, viz: Dr. J. G. Richardson, of Philadelphia.

The author of the letter says, without qualification: "It is a fact that a number of experts are ready to back their opinion with an oath as to the identity of a blood stain with human blood. Notably is this true of Dr. Joseph G. Richardson, etc." Dr. Richardson states very distinctly (*Monthly Microscopical Journal*, of London, vol. xiii, p. 213), "As far as I am aware there is at present, (1875), no method known to Science for discriminating, microscopically or otherwise, the dried blood of a human being, from that of a dog, monkey, rabbit, muskrat, elephant, lion, whale, seal, or in fact any animal whose corpuscles measure more than 1-4000th of an inch in diameter." He also states and very justly, ("Hand-Book of Medical Microscopy," p. 288), that "as a rule justice only requires that only a positive diagnosis shall be made between human blood and that of animals commonly slaughtered for food, such as the ox, the sheep, or the pig; and of birds, as, for example, chickens, ducks, etc." He also states very distinctly (*Monthly Microscopical Journal*, vol. xiii. p. 216), "I wish to insist most emphatically that all my statements in regard to the diagnosis of blood stains are applicable to 'stains' only, and not to masses of dried blood clot."

It would appear from the above that Dr. Richardson's claims are very modest, and his position is simply that if the question of the identity of a blood stain requires the expert to decide whether the given stain is human blood, or the blood of some animal whose corpuscles are oval and nucleated, as in birds, etc., or of some animal whose corpuscles are known to be less than 1-4000th of an inch in diameter, he can state his opinion positively and "backed with an oath," if necessary. Doubtless every one who has made a study of blood corpuscles with high powers, would think it justifiable for him to do so. As to tests, they have been already made with reference to the blood of man, the ox and the sheep, and by no less persons than Dr. Wier Mitchell and Prof. J. J. Reese. Dr. R. identified the corpuscles correctly in every case, (*Monthly Microscopical Journal*, Sept., 1874.)

S. H. GAGE.

Cornell University, Ithaca, N. Y., Oct. 14, 1880.

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High-Angled Objectives.

Ed. Am. Jour. Microscopy—Having had frequent occasion to answer letters of inquiry concerning the recent high-angled 1-8th objectives constructed by Mr. Gundlach, at Rochester, N. Y.—a letter of mine to him having been printed and somewhat extensively circulated—I have thought it might be well, in the interest of all, to beg of you the privilege of inserting a short description of them in your valued journal.

These objectives are homogeneous immersion. With the proper media, and the 10-inch tube, a correction collar is not used or needed; but with other media, or lengths of tube, a collar is required and provided, which, with fluids of an index of 1·525, should be quite closed.

The first one had an interior or balsam angle of 127°, the second 132°, and a third, which I have just examined, has the hitherto unattained—that is, in any practical objective—angle of 138°. All are computed at an index of 1·525 for crown glass.

The working distance of all of these is very remarkable, as they focus easily and with room to spare through covers one-fiftieth of an inch in thickness. I could not find, in Boston, single covers thick enough to fully test them, and was finally compelled to cement two together to find the limit of their working distance.

The performance, with central light, of all of these was very fine, the first and second, being but slightly excelled by the Zeiss 1-12; but the third is, I think, superior to *any* objective I have ever seen.

With oblique light and an immersion condenser they all resolve the Probe Platte, but the third in a manner I have never been able to attain with any other objective.

Their field is very flat, with a sharp and brilliant image, and they bear the highest eyepieces, even the 1-8, with amplifier.

L. M. WILLIS.

Charlestown, Mass., Oct. 3, 1880.

TRANSACTIONS OF SOCIETIES.

Wellesley College Microscopical Society.—The first regular meeting of the Wellesley College Microscopical Society for the college year, was held Oct. 27th, with the President, Miss Hayes, in the chair. After the reading of the minutes of the last meeting, the following papers were read: "On Mosses,' by Miss F. B. Mussey. First—Description of the parts of the Moss, especially the fruit capsule, calyptra, operculum, and peristome.

Drawings showing varieties of these in Polytrichum, Mnium, Bryum and Barbula. Second—Methods of reproduction of mosses. 1. Drawings of antheridiæ and archegonia, antherozoids and protenema. 2. Reproduction by means of gemmæ.

Exhibited under the microscope—slides prepared by Miss Mussey—Antheridia, leaf of Moss, peristome of Polytrichum and Trichostomum.

Second paper by Miss G. A. Painter, on "The Structure and Functions of the Pollen Cell." Illustrations: 1. Transverse section through very young anther, showing parent cells, four-celled by division of protoplasm. 2. Single parent cell showing division of protoplasm. 3. Section of ovary and pistil of Lepidium, showing pollen tubes entering the micropyle. 4. Vertical section of pistil, showing pollen tubes growing down the style. Illustrations 1 and 3 were from original drawings by Miss Painter.

Under the microscope—slides prepared by Miss Painter. 1. Pollen grains with tubes protruding through the pores. 2. Transverse section through very young anther, showing divisions of parent cell into four daughter cells.

Adjourned. L. F. CLARKE, Cor. Sec.

Microscopical Society of Central Illinois.—On September 23rd, the microscopists of Springfield and vicinity met in the office of Drs. Buck and Matthews, and organized under the name of the Microscopical Society of Central Illinois. Dr. F. L. Matthews, was elected President, and T. B. Jennings, of the U. S. Signal Corps, was elected Secretary. As a society, we are in our infancy, but the society is on its own legs, having a number of instruments and a few tolerably experienced microscopists. We will let you and sister societies hear from us occasionally.

T. B. JENNINGS, Secretary.

Fort Wayne Microscopical Society.—Organized Sept. 18, 1880. F. W. Kuhne, President; O. A. Dryer, A.M., M D., First Vice-President; C. W. McCaskey, M.D., Second Vice-President; C. L. Olds, Secretary; Lew R. Hartman, Cor. Secretary; Paul Kuhne, Treasurer.

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EXCHANGES.

Wanted, a good neutral tint camera lucida, to fit eye-piece, 1 26 inch diameter, for 5 fine slides. Address, F. N. Tillinghast, Greenport, Suffolk Co., N. Y.

Lower Silurian fossils from near the Falls of St. Anthony, Minn., for good microscopic material, etc. John Walker, 810 Ave. S., Minneapolis, Minn.

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Graphiology, or Detection of Forgery Under the Microscope.

Paper read by Charles H. Denison before the San Francisco Microscopical Society, Oct. 7. 1880.

THE use of the microscope in the examination of forged or altered signatures, has been the study of the writer for the past six months. This examination has also extended to the permanency of inks, their erasures, the disturbance of the paper fabric upon which they are used, and I have arrived at certain conclusions to which I call your attention. About four months since, I copied from the *Banker's Magazine*, an article purporting to be a discovery by its writer of a certain rhythm peculiar to each individual, and distinguishing one man's writing from that of another. A previous article in the New York *Times* also presents the same subject, and states that writer's theory upon forgery. I quote a few of his words: "Where the methods of the expert (in detection of forged signatures) break down, the most delicate methods of optical analysis represented by the compound microscope interfere to detect and demonstrate forgery. If you follow the tracings of a letter, however rapidly written, you find when examined with a power of ten diameters, and illuminated with a good bull's-eye condensing lens, that besides the larger rhythm there is a minute secondary rhythm, which is imperceptible to the naked eye and cannot be accurately developed with a hand lens, or simple microscope, but which comes out forcibly in the optical image furnished by the compound instrument. This secondary rhythm is traceable to the action of the small muscles in maintaining and regulating the amount of pressure upon the pen. The man that supposes that the pen-pressure is uniform in writing, merely because it appears to be so when reviewed with the naked eye, will be astonished to learn that its variations are between 200 and 300 to the inch, and that they are regular just in proportion as they are spontaneous and involuntary, that is to say, when a man is writing in his natural manner, the variations in pressure upon the pen are perfectly rhythmical, while, on the contrary, while he is consciously imitating the writing of another they are irregular and wanting in rhythmical symmetry, and they remain so just so long as the conscious voluntary movement incident to the act of copying is exercised. If you follow (I still quote him) the margin of a well-illuminated letter in a genuine signature, with a compound microscope you will observe that it is every way the result of a rapidly successive series of muscular impulses, and that these impulses are arranged in rhythmetically symmetrical order. No matter how cleverly a signature may be imitated, as long as the imitator exercises a vestige of the conscious voluntary control of the hand essential to the act of imitating in tracing the letters, just so long the margin of the stroke remains irregular in the length and distribution of the impulses, and the forgery can be demonstrated optically, to the satisfaction of a jury." Having read this portion of the writer's article, I call your attention to his frank statement that with an objective of ten diameters we shall be astonished to learn that the margin of a man's writing shows these so-called rhythmical variations, or impulses of nerves upon the pen, to the number of 200 or 300 to the inch. Yes, it would indeed astonish us. For a better elucidation of the subject, or examination of this astonishing theory, I have the pleasure of exhibiting some genuine and some imitated signatures for your examination. The first one is the rapidly executed signature of the Secretary of the Southern Pacific Railroad Company, which a person would have great difficulty in imitating. The man who can show, and count under any object-glass, of any microscope, 200 or 300 variations in an inch of that signature, will be able to show us what does not exist. You will see variations along the margin of this signature, but they are not caused by any nerve impulses or tremor; but, without doubt, they are caused by the uneven surface of the paper fabric, assisted by capillary attraction. No matter how well rolled or calendered the fabric, under the microscope there are seen fibres and inequalities, and those depressions and swellings of the pulp cause the uneven edges of the ink. As a proof of that declaration, I submit specimens of ink-drops on paper, which have dried undisturbed, and upon the same kind of fabric as the signature—the edges showing the same unevenness and resembling exactly the edges of the signature. You will also observe the straight lines drawn with a ruler upon the same fabric, with the same pen and with the same ink as the drops, which exhibit similar edges. I consider, therefore, that I have established this fact, that there are no regular nerve impulses perceptible, and therefore not comparable by individuality with each other; or, in other words, that this theory is not practical, and cannot be demonstrated before a jury, or court, and that the irregularities seen on the margin of signatures are caused by some other principle than muscular rhythm, or nerve impulses. And having demonstrated this fact, I beg leave to give it as my opinion that it is a theory, and only a theory; and cannot be demonstrated, or at least has not been. On this subject I will only detain you longer by saying that in the report on the examination of the celebrated Cadet Whittaker case, at West Point, a gentlemen of Troy, New York, who is an advocate of this theory, did not report at all on the examination by the microscope, but by comparison of the letters in the ordinary way, showing that the theory was not practical. I have brought for your inspection a *fac simile* of the "note of warning" said to have been received by that cadet, and a copy of a letter written by him a month subsequently. [The Secretary then explained and compared the hand-writings.] But after you have finished the comparison of words and letters, and begun the examination of the fabric upon which a signature or document is written, then I claim that the use of the microscope is invaluable and certain. It is sure to detect any disturbance of the fabric by erasure or addition, and becomes an important factor in the examination. I do not believe any addition or erasure can be so skillfully made that the microscope cannot detect it, seen either by the disturbance of the fabric or the inequality of admittance of light throught it. If time permitted I should be glad to speak upon other tests, but will show only one, and that is in examination of the question whether by use of the microscope the date or priority of writing can be determined. [The Secretary then exhibited figures whose parts were made at different times, taking the figure, and changing it subsequently after drying of the ink to a figure 4.] In conclusion I will add that the compound microscope in Courts of law, to examine disputed wills, documents and signatures, must become a valuable instrument in establishing the genuine or detecting the false signature or document; but in its use I have formed the opinion that the examiner should be called by the Court or Judge, and not by clients, and that his opinions and decisions should be as impartial as those of the Court—otherwise his conclusions might be influenced by the party in whose interest he comes before the Court or jury. He should never lose sight of the fact that his duty is that of an impartial investigator—a Judge rather than an advocate—knowing no client or antagonist.

The discussion which ensued was of a very interesting character, and lasted until a late hour. The specimens of the Secretary were examined, and commented upon with much zest.

Annual Report of the President of the Griffith Club of Microscopy, of Detroit.

Gentlemen—With this evening closes the first year of the existence of this association, and, as your presiding officer, it becomes my duty to review the events of the period.

In the issue of the *Evening News*, dated Friday. Aug. 8, 1879, a letter appeared from the pen of Prof. S. A. Jones, of Ann Arbor, in which, speaking of a visit from Mr. E. H. Griffith, by means of which he had been decoyed from the paths of indifference and peace, and led anew into his former state of insanity on the subject of microscopy, he urges upon the recipient of the missive the establishing of a society of microscopy in the city of Detroit. Acting upon this suggestion, and at the call of W. H. Brearley, a number of gentlemen assembled at the office of Dr. Younghusband and agreed to form a club, to be known in honor of the one whose letter had inaugurated the monument, as "The Griffith Club of Microscopy."

While thus agreeing, an adjournment was made without effecting an organization, which was deferred till the first of October, for which meeting a large number of invitations were issued.

At this meeting, at which about thirty gentlemen were present, committees were appointed looking to the draughting of a constitution, the nomination of officers, and such other matters as are deemed essential to a working organization of such character; and then, with a practical talk on the best method of testing objectives, and a recondite discussion of the merits of wide and low angles, from Prof. J. E. Smith, the new existence was fairly launched into the realms of time and space.

During the year we have had papers on the following subjects:—"Progress and Uses of the Microscope," "Section Cutting," "Diatoms," "Epithelium," "The Circulation of the Blood in Young Fishes," "Adulteration of Tea," and "Crystallization."

Besides these regular meetings, there have been held by the society two public soirees, both of which were well attended by people who evinced a more than ordinary interest in what the—to them—wonderful instrument might have to reveal of the beautiful or the useful.

As the result of all of these means, there has been a steady and perceptible growth manifest on the part of the members of the society, which gives gratifying assurance that the labors and anxieties of its organizers were not in vain.

In this, as in every society of the kind, there have been manifest on the part of the active members two purposes in the work done. To some, perhaps to most of the members who are owners of the instrument, it is largely a source of amusement, serving as a relaxation from the strain of daily toil for bread, while to others it becomes a necessary tool in that same occupation, and thus is translated from the sphere of the entertaining and beautiful to that of the prosaic and useful. The latter are somewhat prone to look upon the former as degrading the use of the noble tube, surrounding themselves unnecessarily with "diabolical accessories," ranging from animal to vegetable and mineral, from sections to crystals, from bees' stings and cats' tongues to vinegar and flour paste.

They say nothing can be accomplished by such desultory work, for the only way to make advancement in science, for which use alone such an instrument should be in the hands of men, it is necessary in these days of multiplicity of knowledge, to confine oneself to some one branch of investigation, and that a narrow one. But, in the name of all lovers of the beautiful in nature, let me enter my protest against such a restricted view. Why should men be limited perpetually to the bounds of a dull and dry utility? When one sits, rapt with the beauty of the colors with which the setting sun paints the heavens, need one therefore be considering just what shades of color enter into the combination, so that he may reproduce the scene on canvas and discourse learnedly of tints and backgrounds? Must none but astronomers be permitted to gaze reverently through the magic tube that brings distant worlds to our very doors? Must none but architects and artists be permitted to stand in awe beneath the gothic arches of the great cathedrals, or to drink in the rich beauties of the Sistine Madonna?

Nay, I sometimes think that the man, who with poetic thought, muses upon the suggestive beauty of the lily or the violet, and loses himself amid the thousand associations that cluster about them, is more nearly in harmony with the inner thought of nature, and makes a truer analysis than does he, who, with glass and scalpel, determines that having several placentæ on the valves of the capsule, with seeds anatropous, embryo straight, cotyledons flat, etc., etc., that it is the *viola cucullata* var. *palmata*.

Not that we would detract from the value of the minute and persevering labors of those who, denying themselves many pursuits that would in themselves promise more present pleasure, evolve, in the seclusion of their studies, results that are a permanent addition to the sum of human knowledge. The world needs many such, and honors them—after they are dead, but the others, the amateurs, the lovers of the beautiful things that God has made, loving them because He made them and because they are beautiful; these, if they will only record their observations and thoughts, do a work no less valuable than the others. We need them both, and may the time never come in the history of our society, when there shall not be a goodly proportion of these more superficial observers, if you wish to call them such, to relieve the monotony of purely scientific discussion and research.

During the year that is now past, there has been a fair balance held between these two elements, with the result that the meetings have exhibited a grateful variety in respect to the subjects presented and in the treatment of them. This has had the happy effect of keeping up the interest of the members as a whole in a marked degree, while it has also attracted the sympathy and co-operatian of the community of which we form a part.

In this respect, especially, the soirees held have been successful, and we number upon our roll to-day many names, and look for the addition of many more, who will be an honor and a help to us; who, but for this cause would have known little and cared less concerning such an abstruse subject as that concealed under the unpronounceable word "microscopy."

The Secretary's book shows thirty active and six honorary members, in good and regular standing, with applications for admission to the society from half as many more. As will be seen from the Treasurer's report, the financial condition of the society is good, the expenses for the year have been small, and have been more than covered by the entrance fees, so that for the present, at least, there is no need of asking for any supplementary appropriation, unless the society should deem it best to make purchases of apparatus. If this is done, it would seem to be better to make a special levy for the purpose, and to keep the reserves in the treasury, accruing from memberships, to defray current and necessary expenses.

I cannot pass over without mention the very interesting and successful meeting of the American Society of Microscopists held in this city during the month of August. It was not without doubtful tremors that we assumed, in the infancy of our organization, to invite and entertain such an august body, composed of men eminent in the annals of scientific discovery, with an unknown amount of dignity to sustain and of expenses to meet, but the ordeal is past, many of those once strangers are now acquaintances and even friends. We have enjoyed the interchange of thought with those who are interested in the same fascinating study that has caused us to band together, and we have drawn the heartfelt sigh of relief at the discovery that after all they are but men, with like passions as ourselves, differing chiefly in the kind and amount of experience they have had, a difference which time and patient work will obliterate, even if it does not throw the balance on the other side.

The experience has been a healthful one, and it will be to our lasting disgrace if its effects are not seen in a more persistent, united and intelligent pursuit of our investigations into the mysteries of the infinitesimal world.

In this connection let us not forget to give honor to whom honor is due for the success of the society as a whole and for a large measure of the success attending the recent meetings of the American Association. It happens in almost every organization that the *onus operandi* falls upon one or two, or at most a few persons. The committee idea of delegated authority is pressed to an uncomfortable extreme in this free country of ours, so that not only the planning and supervising, but the privilege of performing all of the work, is gracefully relegated to a few hard worked and willing souls, who are called a committee, and who are expected, after the work has been well performed, to yield up, equitably and generously, the lion's share of the honorable results that follow their labors. The Griffith Club is no exception to this rule; we are strictly an American institution. But for this time, at least, I must be allowed the privilege of publicly laying the honor at the feet of that most faithful and indefatigable worker, our worthy Secretary, W. H. Brearley. Nor must we overlook the kindness of those who, by placing their convenient rooms at our disposal, have contributed so much to make the meetings of the society agreeable and successful.

While thus our local organization has been steadily feeling its way to a firm footing upon the ground where it could make its influence felt in the world of science, there has been a steady and unremitting progress on the part of microscopical workers on both continents, the detailed mention of whose labors, in their completeness, even if the facts were obtainable in a city where there is such a dearth of scientific literature as there is in Detroit, would occupy far more space than is allowable within the limits of this paper. All discoveries in departments of special science, in which the microscope is used as a collateral to other means of investigation, we must leave to the Surgeon, the Botanist, or the Geologist. In the notices that have appeared from time to time in the scientific journals, there appear evidences of great improvements in the construction of the microscope and its accessories. A leading feature of modern mechanical effort in that direction, and one that claims our heartiest sympathy, is the endeavor to produce an instrument that while being available for a moderate sum, so as to be within the reach of the slender purses that are the almost inseparable accompaniments of a life devoted to mental labor, shall be so well constructed notwithstanding, that they shall be a *multum in parvo*, capable of accurate work, and so constructed so as to admit of the use of all, or at least most of the accessories that are needed from time to time. Not one alone, but many manufacturers, are directing their energies in that direction, aided by the cordial co-operation of practical workers, who know best what are the need of the instrument. We here wish them success.

Simultaneous with this, has been the endeavor to increase the perfection of instrumental finish and adjustment of the more costly stands, so that nothing should remain to be desired in the way of adaptation to the most varied and searching kinds of investigation. As far as mechanical movements, graduations, illuminators and sub-stage accessories go, it would seem that they had almost reached a limit of valuable possibilities, but in the department of objectives suited for the varying grades of work, possessing the requisite degrees of amplification, penetration, definition and spherical and chromatic correction so as to bear the searching test of high powers in the eye-piece, the results attained are very far from being satisfactory.

The problem is a wholly different one from that presented to the astronomer for solution. Let the glasses of his telescope be never so perfect, he has still to encounter the constant tremors of the atmosphere, which, like the waters of the troubled sea, is never at rest. It is, therefore, only on exceptional nights that his highest powers can be used, and at moments whose approach he can by no means predict and which are to be seized only through untiring watchfulness. The difficulties of the microscope, however, lie entirely within the limits of the tube itself, and so can hardly be said to be insurmountable. The science of the proper construction of objectives is still in its infancy, although wonders have already been performed. Many competent men are bending their minds to the remedy of the present manifest defects of these, at present, costly appurtenances, and we look for the near approach of the day, when, with formulæ that, while still practicable, shall conform more nearly to the optical perfection that theory demands, we shall have objectives both of high and low powers, to be used either dry or with such immersion as the nature of the mounting material may demand, which shall bear the amplification of any eye-piece, however great, provided, of course, that it be constructed of sufficient aperture to collect a pencil of rays having the intensity necessary to sensibly affect the retina.

Here and there a maker has produced one, it is true, that has approached in its working to this ideal, but it appears to be rather by accident, and is at once loaded with such a fancy price as to place it far beyond the reach of any except the most wealthy enthusiasts.

In the use of the microscope as an adjunct to medico-legal and criminal investigation, long strides have been made. The researches of Dr. Draper in the arsenic poisoning case, in which, by the study of specimens of the poison taken from different dealers, he was able to decide from which source the article in question was procured, forms an epoch in microscopical literature. The same is true, though in a far different way, of the results of observation in the celebrated Hayden murder trial, in which occurred the most perplexing conflict of testimony from the lips of those claiming to be experts in that kind of analysis. After reading the accounts of that trial, one may well be cautious about giving an unqualified expression of scientific opinion, especially where the interests involved are great, and the hinge upon which they turn is so uncertain and unrecognizable an object as an old blood disk.

One additional characteristic of modern microscopical study I must not omit to mention, in order to commend it to the most careful consideration of the workers of this club. As chemistry reached a speedy limit, never wholly passing from the plains of a recreation to the honorable altitude of an exact science, till chemists learned that accurate weights must be taken of all that they handled, so the microscope must be largely a toy in many of the most important fields of observation, till those who use it will take pains to make and record accurate measurements of the objects they study. There is little that can be denominated "fun" in the slow and painstaking work which this implies, indeed with most of the ordinary means at hand for making such measures, they are worthless when taken. A recorded measurement is of no value unless it is accurate, not absolutely, of course, for that would be impossible as long as human beings are fallible, but there must be the nearest approach to perfection that is attainable. This may sound discouraging, and as though only those who could afford the means to pay for the elaborately graduated instruments could enter upon this field of study. But this is not so. All that is needed is an *accurately graduated stage micrometer*, ruled on glass, and an eye-piece micrometer, whose value in terms of the former shall be exactly ascertained with each objective used.

Such a standard, guaranteed as accurate by the best and most reliable manufacturer, and carefully tested in confirmation by some of the oldest observers, should be in the possession of every society, and I would recommend the purchase of such a piece of apparatus by the society at the earliest opportunity. Then all that would be necessary beyond, would be that each member should have an eye-piece micrometer whose value he has tested with the standard, and that he shall use it.

In conclusion, permit me to make a few recommendations upon points in which it appears to me that we might make some improvement, and so increase the benefit of our society. As a preface to what I wish to say in this line, I cannot do better than to quote a few lines from the address of President Ward at the Buffalo meeting of the A. S. M.

"It is not requisite to affect much learning, incur much expense, or wait for the support of a crowd. It should be remembered that a scientific society or club is not a school to be drilled by one or two pedagogues, nor a lecture association to be regularly addressed, from above, by a few professional lecturers, still less by the same number of amateur instructors, but a body of members affiliated by community of tastes and purposes, who meet on an equal platform for mutual work. * * * * * * * * They will be induced, unless their leaders prove wanting in judgment or in tact, to feel an active interest and mutual responsibility in the work of the society, whatever that may be. And the standard of work in the society even though it should, therefore, be less formal or intellectual than would please a few, should not be set too high to secure the free and somewhat equal participation of the membership generally."

Strong words these and full of good sound sense. Here, if anywhere, we have erred and have assumed too much the character of an audience, waiting to receive gratefully whatever the lecturer for the evening had prepared to test the powers of our mental digestion.

The cause of this has been that we have but half followed out the plan of each evening's work as laid down in our constitution. We have had our stated paper, and have transacted our business, but we have not used properly the time set apart for the "examination of objects and comparison of work," after the manner contemplated by the framers of the constitution. We have not done so, because neither has anyone brought objects of special interest to be examined as illustrative of new and valuable points of discovery, nor have the members favored one another with accounts of work done or difficulties encountered that might be discussed informally. The remedy for this will be found in a more diffused sense of responsibility for the profitable employment of the time at each regular meeting, so that the burden shall not be left solely upon the shoulders of the one appointed by the executive committee to give the stated paper for the evening. Any new and striking fact in any slide, observed by any member of the club during the month, any new process or unexpected difficulty in preparing or mounting an object, with the means by which it was overcome, any adjustment of an accessory that has given unexpectedly good results or a conspicuous failure, if we could lay aside our pride enough to bring forward these little things, and acknowledge our weaknesses, the result at the end of the next year will be an advancement in knowledge and in power of accurate work that will astonish us.

2nd. I would recommend that there be devised, if possible, some plan by which there may be concert of action on the part of many, if not all of the members in the study of certain topics, so as to secure more sure and valuable results from our work. The fields open to the general student, who has neither the taste nor the previous technical training necessary to enter the ranks of the specialists, are numerous, and are both fascinating and promising. A section might be formed for the special study of, say adulterations, who could work together in certain articles of food or commerce, meeting at times intervening between the regular convocations of the society, comparing notes, bringing their instruments and making observations together, making careful notes of all their work and embodying the results in brief reports made from time to time at the regular monthly meetings. The whole time consumed in the reunions of this character need not be large at any one time, while the fruits of such combined labor would be soon reaped in a generous harvest.

The river sediments, the dust of our streets and houses, a systematic study of the natural crystals in plants, critical examination of textile fabrics, handwriting, metal surfaces under various conditions of strain and heat, these, besides the almost innumerable company of subjects that present themselves to the members of the medical profession which is so largely represented here, these, I say, offer matters far beyond the scope of any one observer, while they ought none of them to be neglected in a working society.

3rd. It would be well if the papers offered from month to month were put beforehand in such shape that it would be possible to have them published, either in some one of our daily or weekly papers or in one of the scientific journals of the country. Some of those to which we have listened during the year, are fully up to to the average of those we see in print in most of the papers. They may seem commonplace to the writer, from his very familiarity with the matter, derived through long study, and he may think that only that will be of interest to the general public that seems new and remarkable to him. But just the reverse is the fact, as the strains of Bach and the loftiest soarings of Beethoven or Mendelssohn need the cultivated ear of the trained musician for their full appreciation, while to the general listener they are an almost intolerable bore, so the profound discoveries and abstruse reasonings of the scientist fall upon leaden ears and awaken no response, while the simple narrative of nature's most commonplace wonders—wonders not in that they are rare and profound, but wonders in beauty of design, perfection of adaptation, delicacy of construction, everything that gives evidence of an intelligence and a power beyond our own, this it is whose relation chains the willing attention, brightens the eye and quickens the pulsations of heart and lung, with the healthful intoxication that follows every draught of the pure wine of a new idea. May it not be our ambition rather to make our association helpful to the many, in distributing largely from the ever flowing streams of knowledge that we find so refreshing, than to spend our energies wholly in deep searchings after new and unknown springs, fit beverage only for philosophers after they are found?

In this connection is suggested a field worthy the attention and energies of our society in endeavoring to effect an improvement in the scientific departments of the public libraries of the city. Of this sort of nourishment there is a deplorable lack, as will be painfully evident to any one who essays to "read up" upon any such subject. There should be complete copies of the philosophical transactions, at least of our own country, England and France, records of the proceedings of the great scientific societies, complete sets of the scientific magazines published in the English language, the best monographs published in departments of general and microscopical science. I know that all this means a great deal, but I am assured that suggestions as to valuable and desirable books will be gratefully and favorably received by the managers of these libraries, and I am sure that much might and ought to be done in this line in a public spirited way by the citizens of Detroit, placing on the shelves, at least of the public library, copies of such works as those above indicated. Let the members of our club take the initiative in this respect and then see to it that their friends follow their example, as far as they have influence with them to induce them to do so, and we shall soon have a reference library worthy of the otherwise deservedly proud name of this beautiful city.

And now, gentlemen, in resigning into your hands the office with which you have entrusted me for the past year, let me thank you for the hearty co-operation with which you have met and furthered the plans of your officers. We have no need to feel ashamed of what we are as an organization at the close of this, our first year of existence.

But whatever we are, hard work has done it, and if we would not sink into rapid decay, hard work must still be done, not only by those upon whose shoulders the mantle of office shall fall, but by each other one of the club, "a long pull, a strong pull and a pull all together;" this it is that will win the race; let this be our motto, worked out into practice, and the day is not far distant when it will be no empty honor to be known as a member of the "Griffith Club of Microscopy." E. W. Wetmore.

Detroit, Sept. 8th, 1880.

Machilis.

One afternoon, towards the end of August of this year, the writer formed one of a party at Eden, Bar Harbor, Mount Desert, to visit "The Ovens," a favorite resort about five miles distant from "The Harbor," to the northward. One half of the party proceeded by "buckboard," a very capital four-wheel vehicle for excursionists, consisting of the two pairs of wheels, a long board platform resting upon the hinder axle tree, and upon the cross bar carrying the fifth wheel in front, and of seats resting crosswise upon the spring floor; while the other half glided over the smooth waters in birch bark canoes, each one being propelled by a Passamaquoddy, or 'Quoddy Indian, and one of them paddled by Lola, the chief of the tribe. The sun was declining as the pleasure seekers reached the rocky bluffs, rough and scarred by frost and stormy water, excavated into deep oven-like recesses, or rent here and there by the forces of winter, which had torn away huge blocks that lay at the base.

At one point a massive fragment almost barred passage to the pedestrians, but a way was still open through which single file they could go beyond. The younger folks pressed forward, but we waited with others for a more leisure transit. In advancing towards the defile, we looked upon the rock, which was of a cinereous gray color in the fading light of early evening, when our attention was arrested by the appearance of life upon its surface, a short line of motion, an arrest, a new line making zig-zag with the other, a new pause, and then nothing. The object was hardly perceived ere it vanished, for the eye, following its action, ran beyond when it suddenly paused, wherefore a new search had to be made. A close approach rendered the objects plainer, whereupon they were found to be minute, attenuate, grayish creatures, about 0·5 inch in length, provided with cephalic and caudal setæ, gliding or springing from place to place, and recognisable less certainly by their contour than by their motion and feeble shadow, for their hue hardly differed from the sombre surface on which they lived. They were Thysanuras; they called to mind the Lepismas, but were not silvery; they were crepuscular, for they had never before been met with in our day rambles; and their habitat was upon the bluffs or rocks washed by the tide.

We caught several of these apterous insects, bestowed them for future study, and joined the excursionists who were waking the echos along the beach.

Reaching home sometime afterwards, we opened our crypt, but were filled with regret that many of the details of form and marking had been effaced; but while these were hopelessly gone, my friend, Prof. P. R. Uhler, recognized *Machilis* in the compressed specimens, and we found confirmation of this diagnosis in a study of the scales which I had mounted.

The British *Machilis maritima*, is described in the "Monograph of the Collembola and Thysanura," by Sir John Lubbock, London, 1873, but the condition of our specimens forbade differentiation. Say also noticed an American Machilis, M. variabilis, many years before. (Say, Jour. Acad. Philadelphia, 1821). Yet while he spoke of it as occurring "in every temperate part of North America, and as far south as East Florida," he referred in a general manner only to varieties. And finally Joseph Beck, (Lubbock *l.c.*) gives a description of a single (dorsal) scale of M. polypoda and of M. maritima, adducing an engraved illustration of either. The text of Mr. Beck, is as follows: "M. polypoda, *Scales:* From 18 to 24 strongly marked, compressed ribs, parallel to pedicle, well defined cross-markings between and at right angles to main ribs. External surface of under membrane, straight longitudinal corrugations; external surface of outer membranes smooth, nearly flat, indications of nodulations near to and radiating from pedicle; cross lines due to structure between superposed membranes. M. maritima. Scale same as that of M. p.; scale longer in proportion to width; the longitudinal ribs not so numerous, varying from 12 to 15."

The foregoing description is sufficiently exact for one kind of scale, or better said, for scales from one part of the body; but fails to notice points which have attracted our attention, and which are, first, the variety of forms and disposition of the ribs in scales derived from the back, side, and belly; and, secondly, the point of implantation of the pedicle which is on the *under surface* of the scale *remote from its unbroken* border. This latter circumstance, added to the existence of a joint, refers, we are of opinion, to the better protection of the spiracles in the damp places that Machilis inhabits, and during immersion if overtaken by storm or tide.

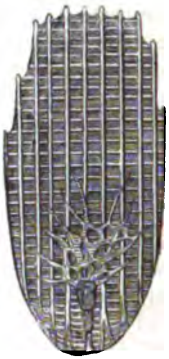

Fig. 1.—SCALE FROM THE BACK.

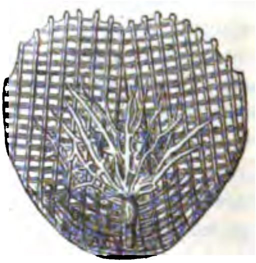

Fig. 2.—BELLY FORM.

In short, some of the scales, the dorsal ones, answer to the description given by Beck. These are elongated, approach a parallelogram, and are as if stained of a very pale brown color.

Others, for the belly, are ovoid or cordiform, less widely rounded near the pedicle, and bearing ribs which, like the former, indeed, like most of the other scales, are forked more or less constantly at the lesser end.

And finally, scales, chiefly from the sides, and presumably associated with other varieties at or near the joints, of very irregular outline, are more finely marked than both of the preceding, and in which the *ribs constantly*, as occasionally in the second variety, meet at an angle opening towards the pedicle, and form a zig-zag along a devious median axis. It is also to be noted that faint curved lines exist behind the pedicle in all the scales, with corresponding fineness in the markings, especially in those asymmetrical small scales, which resemble, *en petit*, the fossil tooth of Acrodus, or the coral known as Fungia; and that the base of the pedicle is associated with a system of corrugations, resembling rootlets most extensively, if not most conspicuously developed, in the ovoid or cordiform 'plumules.'

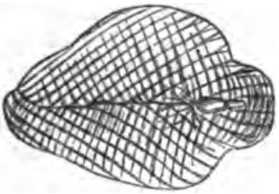

Fig. 3.—SIDE FORM.

In conclusion we would observe that the construction of these scales, as, perhaps, of those of all lepidopterous creatures, may be illustrated by that variety of Japanese fan of which the radiating ribs, split out of a single joint of a reed or cane, are covered on either side with a thin membranous paper; but the resemblance ceases when the attachment of the pedicle is considered.

CHRISTOPHER JOHNSTON, M.D.,

Baltimore, Sept. 12, 1880.

Permanent Microscopic Preparations of Amphibian Blood.*

BY PROF. SIMON H. GAGE, OF CORNELL UNIVERSITY.

THE very excellent method of drying the corpuscles of mammalian blood on the microscopic slide, is not applicable to the much more bulky corpuscles of Amphibia. The corpuscles of the latter are sure to be distorted and seamed in drying; hence various methods of preserving the corpuscles moist have been tried with varying success.

The following very great modification of the method proposed by Ranvier in his treatise on histology,† has been in use for some time in the Anatomical Laboratory of Cornell University, and has given uniformly excellent results. Preparations made three years ago are quite as good as at first.

Three or four drops of fresh blood are allowed to fall into 10 cc. of normal salt solution (common salt 750 milligrams, water 100 cc.) preferably contained in a high narrow vessel like a graduate glass or beaker. The mixture of blood and salt solution should be well agitated, and then 100 cc. of a saturated aqueous solution of picric acid added with constant stirring. After the corpuscles have settled, as much of the supernatant liquid as possible is poured off, and in its place is put about an equal volume of normal salt solution. The corpuscles are allowed to settle, the liquid poured off, and another volume of salt solution added. This is continued until the salt solution acquires only a faint yellow tinge.

The use of the salt solution is, first, to dilute the blood in order to avoid distortion of the corpuscles, and second, to wash away the picric acid so that the subsequent staining will be more satisfactory.

After pouring off the last salt solution, there is put in its place 10 cc. of a mixture of five parts of Frey's carmine and ninety-five parts of picrocarmine. The corpuscles will stain in from one to fifteen hours. A drop of the agitated mixture should be examined occasionally to ascertain when the staining is sufficient. The nucleus should be deep red, and the body of the corpuscle yellow or pinkish.

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* Read before the Sub-Section of Microscopy of the A. A. A. S., at the meeting in August, 1880.

† Traite technique de Histologie, p. 195.

When the staining is completed, as much stainer as possible should be poured off, and in its place 10 or 15 cc. of acid glycerine (glycerine 100 cc., acetic or formic acid 1 cc.) This mixture of corpuscles and glycerine may be placed in a bottle and used at any time, it being simply necessary to agitate the mixture slightly or to take up some of the sediment with a pipette and mount it precisely as any other glycerine preparation.

Summary.—1. The fresh blood is first diluted with about fifty times its volume of normal salt solution.

2. To this diluted blood is added ten times as great a volume of a saturated aqueous solution of picric acid.

3. The picric acid is washed away with normal salt solution.

4. The corpuscles are stained with picro-carmine, or a mixture of this and Frey's carmine.

5. They are preserved in acid glycerine, and may be mounted for the microscope at any time.

Bloodstains as Evidence in Criminal Cases.*

BY CHAS. O. CURTMAN, M.D., ST. LOUIS, MO.

THE detection of bloodstains on linen or other articles of apparel, has often a melancholy interest to the medical expert and the criminal jurist. In many cases, the decision of court and jury has hinged upon the evidence afforded, or supposed to be afforded, by suspicious stains found upon clothing or implements used by persons accused of murder. Not very long ago it was imagined by the public and even by members of the profession and enthusiastic admirers of the microscope, that human blood might be positively and easily identified by the microscope. Upon the extension of the scope of utility of the spectroscope, that instrument has also been held by many to be an unerring detective of blood.

But by degrees the illusion in regard to the positive and unassailable results of the microscope has vanished, and at present, (especially since the thorough investigation of the subject by Dr. J. J. Woodward, U. S. A.,) no expert would be found bold enough to assert, in the face of contrary evidence, that he can positively identify *human* blood by any microscopical device. The blood discs of the *dog*, especially, are so nearly of the size and shape of human blood, that no means, at present known, will discriminate with absolute certainty between the two, even in the fresh state, much less after having been dried and subjected to the methods of preparation necessary for microscopical investigation. The spectroscope does, with great accuracy, reveal the presence of blood, by the absorption bands characteristic of the hæmoglobin, but cannot make any distinction between the various blood corpuscles affording the coloring matter.

But even were all of those difficulties successfully overcome, and could the minutest distinctions be made between the different kinds of blood, such evidence would, in many cases, be rendered absolutely nugatory by the doubts thrown upon the source of the blood and its manner of transfer to the stained article by the following facts:

Having been applied to, last winter, to make examinations of suspected bloodstains, the thought occurred to me that there is a possibility of the transfer of human blood by means of predatory insects, such as the mosquito, the bed-bug and similar others. Experiments showed that the crushing of such an insect, loaded with its meal of human blood, will yield a stain of considerable size, much larger than I had anticipated. I then captured some mosquitoes, after they had imbibed their fill of blood, and kept them alive in close confinement. They were then, after different periods of time, crushed and the blood examined, mixed with various menstrua for dilution. In all cases up to forty-eight hours I found a large proportion of the red corpuscles of human blood is still unchanged, and quite readily recognizable. I next examined the blood of the mosquito, which had not been permitted to feast on the human subject. The size and color of these corpuscles of mosquito blood are so different from human, that no mistake can possibly arise from this source.

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* Read before the St. Louis Medico-Chirurgical Society.

In the last few weeks Dr. E. Evers was kind enough to assist me in a considerable number of micrometric determinations of human blood taken from the mosquito, after various intervals, and the corpuscles of mosquito blood proper. The task has been a laborious one, owing to various difficulties, not the least among which was the selection of a proper menstruum for dilution. Glycerine in various dilutions, gave excellent definitions of the human blood corpuscle, but left the margins of that of the mosquito so ill-defined as to make accurate measurements very difficult. After various trials, we found alcohol of about 80 per cent. the best medium for examining mosquito blood, and very fair for the human blood corpuscle, although both shrink somewhat in the alcohol.

Our results* are as follows:

Human blood (after imbibition by the mosquito) averages (red corpuscle,) in dilute glycerine, 7.4 micro-millimetres, (or 1-3200 inch); in 80 per cent. alcohol, 6.9 micro-millimetres, (or 1-4000 inch.)

Mosquito blood averages in dilute glycerine, 1.8 micro-millimetres, (or 1-14000 inch); in 80 per cent. alcohol, 1.4 micro-millimetres, (or 1-18000 inch).

The subject appears to me to be of sufficient importance to deserve further investigation. However much we may regret that another prop is taken from the value of circumstantial evidence, derived from suspicious stains in murder cases, it is best to know and make proper allowance for any weak points of such information. For even if stains should now be fully identified as derived from human blood, the accused may plead in his justification, that they are due to the agency of insects and cannot be allowed to furnish any proof of his guilt.

Since reading the above paper before the society, investigations with the bed-bug (as yet very few in number) appear to show that the imbibed human blood is destroyed far more rapidly in them than in the mosquito. In one individual, after twelve hours, not a trace of human blood corpuscles could be detected.

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* These results are the average of more than one hundred careful measurements.

Permanent Microscopic Preparations of Plasmodium.*

BY PROF. SIMON H. GAGE, OF CORNELL UNIVERSITY.

THE previously published methods of making permanent preparations of the motile or naked protoplasmic stage of the Myxomycetes are but two, so far as I know; and no method of getting the Plasmodium in a desired position has to my knowledge been published.

The old method was to dry the extended Plasmodium, the new is to harden it with osmic acid. Both these methods are defective, for osmic acid changes the color of the protoplasm, and drying causes it to shrink as well as to change color.

The following is a simple and efficient method of extension and preservation: Small pieces of the rotten wood, on which the Plasmodium is found, should be placed on moistened microscope slides with some of the Plasmodium touching the slides. These should be on a piece of window or plate glass, and over the whole should be placed a bell-jar, or other cover, to prevent evaporation. After an hour or more the glass on which the slides rest should be lifted up to see whether the protoplasm has crawled out upon any of the slides. If any of the slides are satisfactory, lift off the bell-jar and remove the pieces of wood from the slide. The Plasmodium will remain.

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* Read before the Sub-Section of Microscopy of the A. A. A. S., at the Meeting in August, 1880

The slide should then be put very gently into a mixture of equal parts of a saturated aqueous solution of picric acid and 95 per cent. alcohol; it should be removed in 15 or 20 minutes, and placed, for about the same length of time, in 95 per cent. alcohol; it may then be mounted in Canada balsam in the usual way, but without previous clearing.

The picric acid stiffens the protoplasm almost instantly, but does not shrink it; the alcohol removes the water and allows of Canada balsam mounting.

The above method is especially good for the yellow Plasmodium, as the color is precisely that of the picric acid solution. If white Plasmodium is to be mounted it should be soaked in 25 per cent. alcohol to remove the yellow color of the picric acid, before anhydrating it with strong alcohol.

Experiments have not been tried with Plasmodium of purple and other colors to determine successful methods of preservation, but some slight modification of the above is confidently expected to succeed.

SUMMARY. A.—The Plasmodium will crawl from rotten wood and extend itself on a moistened glass surface.

B.—The extended Plasmodium may be fixed in position by immersing the slide on which it is extended in a solution of picric acid.

C.—The slide may be placed in 95 per cent. alcohol to anhydrate the Plasmodium, after which it may be mounted in Canada balsam.

D.—The yellow Plasmodium retains its natural color if treated in this way.

Ithaca, N. Y.

Current Notes.

The "Half Button."—Through the kindness of Messrs. Ross & Co., we have received one of Mr. Wenham's illuminators, described at page 164, of Vol. IV., of this journal. It has been christened the "Half Button," and is very efficient and easily used.

Personal.—One of our contemporaries has announced that the Rev. W. H. Dallinger, of Liverpool, so well known as an accomplished microscopist, is coming to this country to take the appointment of President of one of our American colleges. Unfortunately this is too good news to be true. Dr. Dallinger has accepted the position of Governor and Professor of Biology at Wesley College—but this institution is, we believe, located at Sheffield, England.

An Important Work.—A paper "On the Function of Aperture in Microscopic Vision," by Prof. Abbe, of Jena, has come before the Royal Microscopical Society, of London. As the paper would occupy about 150 pages of the *Journal*, the Council have decided to print it as a separate volume. Copies will no doubt be for sale separately, and so will be available to American students.

Preservation of Tube-Casts.—It is well known that tube-casts are amongst the most difficult objects to preserve for microscopical examination. Prof. J. B. Marvin suggests (in the *Medical Herald*) a new preservative—*bile*. He says: "We have tried chloral hydrate, creasote, carbolic acid, and salicylic acid, etc., but with only poor results. Five years ago we had for examination a sample of albuminous urine which contained bile, and large quantities of tube-casts and renal epithelium. The renal derivatives were so numerous and so beautifully colored, that a drop of the sediment was placed on a slide and covered—a ring of cement run around—intending to use it as a temporary mount for class demonstration. The casts, etc., remain perfect to this date. Would not iodized serum, to which a small quantity of bile has been added, prove a good preservative and coloring agent for organized products of this kind? Try it and report."

Bismarck Brown as a Staining Fluid for Microscopic Sections.—At a recent meeting of the New York Surgical Society, the *Record* says: "Dr. Satterthwaite presented, on behalf of Dr. W. H. Porter, a number of microscopic slides, which exhibited the action of some new reagents that had come into use for histological work. He exhibited a normal human kidney, injected in two colors, but which had subsequently been stained in Bismarck brown. The method was practically the same as that given by Weigert (*Archiv f. mikrosk. Anat.*, xv., p. 269). A concentrated aqueous solution is made by boiling and adding of the dye, 3 grains, to distilled water, 1 ounce. The liquid is then filtered. Sections are immersed from half an hour to half a day. The longer period is found the most desirable. After removing from the bath they are placed for five minutes in a five per cent. solution of acetic acid. They then are passed through alcohol and oil of cloves, after the usual methods, and finally mounted in Dammar varnish. The color affects chiefly the epithelial elements which are clearly differentiated from the surrounding connective tissues. The borders of the corpuscles take a bright brownish-yellow, the nuclei an ochre-brown. This coloring material appears to be the best we have at present for epithelium. It was observed that in the convoluted tubes of the kidney the striations of Heidenhain were unusually distinct.

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AND
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Important Notice.

We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II, III, and IV, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

Those who wish to have their numbers bound, can do so for 35 cents per volume. Mailing 12 cents additional.

Foreign Subscribers.—Subscribers in Great Britain and the Continent of Europe will be supplied at the rate of $1.20, or 5 shillings sterling per year, postage paid.

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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the **American Journal of Microscopy**. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

The "Morey" or "Chinese" Letter.

THIS letter, or rather the envelope in which it was enclosed, possesses some little interest to microscopists from the fact of its having been the subject of a microscopical examination, the object of which was to determine whether the document was genuine or a fabrication. The envelope became the subject of scrutiny at the hands of three microscopists—Mr. Hagen, of Troy, Mr. Gaylor, of the New York Post Office, and the Editor of this journal. Unfortunately for these gentlemen, there was very little credit to be gained by the investigation, for the fraudulent character of the document was so simple and obvious that it did not require the services of an "expert" to decide in regard to it.

The points upon which the microscope was called to give testimony were these: 1. The character of the apparent erasure on the face of the envelope. When held against the light, the envelope showed clear and unmistakable traces of a name to which the title "Esqr.," had been affixed. This name showed in light letters on the darker ground of the thicker and consequently less transparent paper, and the question was: Could this name have been impressed in the paper from which the envelope was made (after the manner of a water mark,) or was it an erasure, and if so, on which side of the paper had the erasure been made?

The microscope clearly showed that an erasure had been made on the front or face of the envelope, and that this had been done with a sharp scraping instrument, the *utters* or ridges which such a process usually leaves behind it, being distinctly visible.

2. The second point was in regard to the post office stamps. None of these stamps had any dates on them, and the question was: Were the dates which should have been there absent because the stamping was imperfectly done, or had they been subsequently erased by some mechanical means?

Under a low power it was seen very clearly that all the stamps contained erasures at the points where the dates should have been. Whether these erasures had been made by some sharp steel instrument or by some rough substance like sand-paper, or the coarse-grained rubber often used as an eraser, it was difficult to say. The fact of an erasure having been made was, however, perfectly obvious, and this erasure was not due to the friction to which the envelope had been subjected in the usual handling, and carrying in the pocket. If this had been the case, the general surface of the envelope would have showed rubbing; but it did not. The disturbance of the fibre was confined to the spots on which the post office dates should have appeared, and the inference was consequently irresistible that these erasures had been made intentionally.

3. The microscope also gave testimony as to the character of a certain line which simulated the slanting stroke in the figure 4, which was claimed to have formed part of one of the dates. The letter was dated January 23rd; professing to have been mailed in Washington on that day, it should have reached New York on the 24th. A letter 2 which had escaped erasure in the New York stamp was claimed to be the first figure of 24, and the slanting stroke just referred to was claimed to form part of the 4. But under the microscope it was clearly seen that this stroke had not been made with a *stamp*, but with some instrument like a pencil which had been *drawn along*—leaving streaks in its wake as the finger, drawn over smooth, clean glass, leaves a series of lines behind it.

Other questions, such as the absence of the Lynn stamp, and the presence of New York stamps, as bearing upon the genuineness of the envelope, were not subjects of microscopical investigation.

As we previously remarked, the forgery was so obvious and clumsy that no great skill or experience was necessary to detect it. It could not have deceived an intelligent, unprejudiced school boy. Still, the microscope added to the certainty of the conclusions to which the unaided vision pointed. and, in so far was probably valuable.

Our Book Table.

The Vision; or Hell, Purgatory, and Paradise of Dante Alighieri: Translated by the Rev. Henry Francis Cary, A.M., with life of Dante, Chronological View of his Age, Additional Notes, and Index. Illustrated after Gustave Dore. From the last corrected London Edition. Complete in two volumes. Vol. I. New York: Carl von Buhren, 104 John Street.

The great poem of Dante is too well known, by reputation at least, to require comment at our hands. There are many famous poems which nobody reads, although it is fashionable to claim some acquaintance with them, but Dante is one of those that will be read by intelligent men and women when the opportunity presents itself. Aside from local political allusions, which perhaps have lost their force with men of a later day, the Vision presents so much that is wierd and strange, and the language and ideas are so entirely out of the usual line of thought, that the Vision must ever hold its place amongst the books which are read by those who wish to acquaint themselves with the prominently distinctive phases of literature.

The volume before us forms a handsome quarto, which has been prepared with great care; the paper and typography are of the first quality, and by means of the heliotype process, the magnificent designs of Dore have been placed within the reach of every one. Mr. von Buhren deserves great credit for his effort to place such a handsome work within the means of persons in moderate circumstances.

Hand-Book of Urinary Analysis; Chemical and Microscopical: For the use of Physicians, Medical Students, and Clinical Assistants. By Frank M. Deems, M.D., Laboratory Instructor in the Medical Department of the University of New York; Member of the N. Y. County Medical Society; Member of the New York Microscopical Society, etc. 12 mo., Limp Cloth, 25 cents. New York: Industrial Publication Co.

This Manual presents a plan for the systematic examination of liquid urine, urinary deposits, and calculi. It is compiled with the intention of supplying a concise guide, which, from its small compass and tabulated arrangement, renders it admirably adapted for use, both as a bed-side reference book and a work-table companion. The author is well known as one who has had for several years a very extended experience as a teacher of this important branch of physical diagnosis, and he has compiled a manual which will serve to lessen the difficulties in the way of the beginner, and save valuable time to the busy practitioner. The arrangement of the matter, and the small though clear type in which it is printed, has enabled the author to compress a great deal into a very small compass, so that, while serving all the purposes of an analytical table, it is really a good deal more, although it is not, of course, to be supposed that this brochure can take the place of larger books.

BOOKS RECEIVED.

Naso-Pharyngeal Catarrh. By Martin F. Coomes, M.D., Professor of Physiology, Ophthalmology, and Otology in the Kentucky School of Medicine; Member of the American Medical Association, the Kentucky State Medical Society, etc., etc. Louisville, Ky.: Bradley & Gilbert.

Hygienic and Sanative Measures for Chronic Catarrhal Inflammation of the Nose, Throat, and Ears. Part I. By Thos. F. Rumbold, M.D. St. Louis: Geo. O. Rumbold & Co.

Correspondence.

The Editor of the American Journal of Microscopy does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Apertures in Opaque Mountings.

Ed. Am. Jour. Microscopy.—One of your correspondents asks me to give some directions in regard to leaving the small openings into the cells of opaque mountings, which I have so often recommended. I do so with pleasure. Whatever may be the material of which the cell is made, whether cement, or curtain ring, or hard rubber, file a little notch on the top of it, and on what will be the lower side of the slide, with a thin dentist's file, and large enough to lay a pin in the opening. Then, when the object is secured in the cell, moisten the rim of it, except in the notch, with Canada balsam, and apply the thin glass cover. After a day or two, balsam of the thickness of common syrup may be applied around the edge in such quantity more or less, as one may fancy, care being taken to avoid the minute aperture. Or, if the balsam should happen by accident to run into the opening, it may be easily drawn out with a pin or needle applied a few times. With the point of a knife, on the turn-table, first push off any balsam that may be on the cover glass, then gradually work it up on the slide until the edge of the mounting is a true slope or curve as you may desire.

I use for my own opaque mountings, cells made of bleached shellac cement and thoroughly dried. They are translucent, and therefore admirably adapted for the parabolic reflectors. The balsam in this case forms a beautiful finish, and I find no difficulty in applying it without interfering with the aperture. I do not regard wax cells as safe to use for any mountings without first being covered with some cement, such as liquid marine glue, or gold size and damar. If I should use these cells for opaque mountings I should cut the notch in them before being covered with cement.

I have tested this simple little device of leaving a minute aperture in the cells of opaque mountings, for the past three years, and I do not know that I have had a failure in a single case that was owing to the mounting. While in hermetically closed cells, there would be haziness, or the running of cements, or some trouble after a time with nearly half the specimens.

C. C. Merriman.

Synopsis of the Belgian Diatoms.

Ed. Am. Jour. Microscopy.—It gives me great pleasure to commend the above named work to Students of the Diatomaceæ, as one that will prove of great value to them, and which will supply a long-felt want. Since the publication of the British Diatomaceæ, many years ago, and now out of print, there has really been nothing to supply its place, accessible to the general student.

Dr. Van Heurck is entitled to great praise in attempting to do for the Belgian, what W. Smith has already done for the British diatoms, but with this difference, however, in favor of the later work, viz., it will embrace a great number of additonal forms not described in the British Diatomaceæ, and will largely correct the nomenclature. Although the plates are not quite equal in artistic merit to those of the last named work, yet they are really very good representations of these interesting objects, and quite sufficient for identification. The association of the well-known author, A. Grunow, with Dr. Van Heurck in the preparation of this work, gives it addititional value, for no one has a more complete knowledge of the diatoms, or is a more laborious student of them than Herr Grunow, and, while we think that he has unnecessarily made some new species out of forms that appear to us scarcely distinct, yet as this is still an open question, we are not disposed on this account to find fault with what promises to be so excellent and useful a book.

Fascicle I, has already appeared with ten plates, being Part I of the Raphiduæ.

It is proposed to issue the book in six Fascicles, of about ten plates each, and after the completion of them, a descriptive volume of text. Every microscopist should become a subscriber to this really valuable work. H. L. Smith.

[Dr. Van Heurck's work has been noticed before in this journal, and it gives us great pleasure to have attention called to it again.

In addition to what Prof. Smith states, we may repeat that the price of the work is 75 centimes (15 cents) per plate, each fascicle containing about ten plates. The volume of text will cost $1.50. Orders may be sent to Mr. Stodder, 131 Devonshire street, Boston, to the editor of this Journal, or to Dr. Van Heurck direct. Dr. Van Heurck's address is: Rue de la Sante, 8, Anvers, Belgique.—Ed. Am. Jour. Mic.]

Mounting Pollen in Balsam.

Ed. Am. Jour. Microscopy—Last Spring I stumbled upon a method of mounting pollen in balsam which has worked better than any other way I have yet tried. As I have not seen it recommended in any work or paper on the subject, I give it for publication.

Place your pollen in position by sticking the anthers upon the slide, then cover your pollen with a drop of balsam. Now hold the mouth of a bottle containing sulphuric ether as near the balsam as possible. The warmth of your hand will cause the ether to evaporate. The vapor is taken up by the balsam which now begins to spread. Apply the cover glass at once, and continue to hold your bottle of ether to the slide until the balsam has spread in all directions to the edge of the cover glass. This process spreads the pollen evenly over the slide in all directions, and prevents it adhering in clusters. Pollen can be mounted fresh by this means and does not need drying. Air bubbles are almost impossible.

F. O. JACOBS.

◆

A Good Preservative.

Ed. Am. Jour. Microscopy—In the August number of your journal, I see the use of borax recommended as a solvent for salicylic acid for vegetable preparations. I have been using for the last three years a solution of salicylic acid made after the following formula:

Saturated solution of acetate of potash, ¼ oz.; distilled water, 3¾ oz.; salicylic acid as much as it will take up.

In this I have preserved renal epithelium and tube casts, both mounted and in vials, for nearly three years, and they are as perfect to-day as when I put them in it. I have also, algæ and diatoms, which have been perfectly preserved in it for two years without change of color.

HENRY FROEHLING.

Baltimore, Md.

◆

A "Zephyr" from Illinois.

Ed. Am. Jour. Microscopy—Permit me to say:—we value your journal highly, but seriously object to the "Fell" purpose of padding, as illustrated in October number. Fourteen pages are given to the Detroit meeting, when four pages would suffice. This is a sample outrage. Is your journal conducted simply for the purpose of permitting certain owls to exhibit their mode of winking? Again, cut down, or compel your correspondents to condense, their letters. We want facts *and* experience, concisely stated.

Reviewing Wythe's book, you mention that he omits a description of Wenham's reflex illuminator and Smith's vertical. Why does not *your* journal give us a series of illustrated articles on these and all other accessories, and the best method of use? Beck's book of 1865 is the only book that pretends to describe such matters fully, but that fails. Makers of apparatus ought to do it. They do not. A large number of your readers are pupils. They need instruction, not at hands of bungling "aperture" men, but of men capable to teach practical microscopy.

At your leisure, notice for us these questions. *Best* results of one inch objective. *Simple* rule to get best definition from 1-5 or 1-10 objective with collar. The polariser, its use, and selenite plates; Wenham's and Smith's illuminators; their use and purpose. *Eye-Pieces*, Huyghenian, orthoscopic, negative, periscopic, solid, etc. How Wenham's binocular differs from Tolles' binocular eye-piece; parabolic illuminator, its use etc. Amici prism, etc. etc. In the course of a year or two what a grand book such a compilation would make. Don't refer us to Beale, Carpenter, Frey, Hogg, Phin, or anybody. They are like Wythe.

EUGENE, *et als.*

[The above letter is interesting as presenting one side of an important question—What are the needs and wishes of the subscribers to this journal. First of all, however, we are glad to have the opportunity of saying that any *blame* which may attach to the publication of the report of the Detroit meeting rests with the Editor, and not with Mr Fell. Mr. Fell furnished us with the report at our special request, and deserves great credit for the able manner in which he performed his work; all the blame, therefore, belongs to the editor, and the credit to Mr. Fell.

In extenuation of our own offence, however, we would say, that it is very desirable to have in the current journals, a full, and accurate report of all such meetings. We know these reports are highly prized by many of our readers. But in addition to this, it is a fact that we gave our readers nearly the whole of that report as extra matter. The JOURNAL for October contained eight extra pages, and after deducting the entire report, the remainder of the number contains more matter than is to be found in one number of any scientific journal published at the same price in this country.

It is not the object of a journal to teach the elements of any art or science. This is the proper function of text-books, and, therefore, when we criticised Dr. Wythe's book on account of such omissions, we were justified in doing so. The subjects named by our correspondent are described by Carpenter, and will be fully discussed and explained in our large book, but unless as regards new modifications or new methods of using them, the journal is not the proper medium for describing them. Of course we may sometimes make exceptions to this rule, but on the whole we believe it to be sound. As regards correspondence, it would be unfair to a correspondent to change his matter. We try to give every one a "fair show," but we do ask them all to be as brief as possible. ED. AM. JOUR. MIC.]

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Rochester Microscopical Society.—The Rochester Microscopical Society held its first regular meeting since May in the Free Academy Building. About thirty members were present. Professor Lattimore presided. After the minutes had been approved, Dr. J. Edward Line read a paper on "Teeth, their Structure and Development." Dr. Line gave Owen's definition of teeth. He then proceeded to explain their uses. The primary office of teeth is the trituration of food. The secondary uses are: First, aids to the speech; second, indices of age; third, of sex; fourth, offensive weapons; fifth, defensive weapons; sixth, aids to locomotion. In most animals they perform more than one of these functions; in a few they do not perform the primary function of trituration.

The composition of teeth is a basis of animal matter, calcareous, silicious and corneous substances. Chemically the composition is phosphate and carbonate of lime with other salts in small quantities. In number, teeth range in various animals from one tooth to the innumerable teeth of the pike. They are situated in the mouth, upon the jaws, or even in the stomach. They are attached by a ligament to the socket. There is no limit to the succession of teeth in fishes and reptiles. In mammals they are limited to one or two sets.

The growth and development of teeth is one of the most difficult subjects of investigation, and many things are yet unknown in regard to it. The parts of a tooth are the dentine, enamel and cement, the pulp or nerve and the peridental membrane. All these have their origin in the mucous membrane covering the jaw, and these tissues are all present in highly developed teeth. The fact that teeth originate in the mucous membrane has given them a place among the appendages of the skin.

Dr. Line proceeded to explain the development of teeth, illustrating his remarks with seven sketches of the various stages of growth. The dental development in man begins at the end of the seventh week. The development of the cement is a matter of dispute. The dentine, as seen in the microscope, consists of small tubes with transverse branches. The enamel appears as hexagonal rods. The cement is filled with spider-line cavities.

Dr. Line closed his paper with instructions as to the method of preparing parts of a tooth for microscopical examination. He said that teeth, like warm meals were to be had at all hours. The jaws of sheep and calves could be obtained from butchers, and as for cats, (neighbor's cats preferred), they can always be obtained from the back yard fence.

The members of the society then questioned Dr. Line on the points of his article, especially as to the preparation of soft specimens of teeth, and also upon the coloring of soft objects.

A. T. Atwood explained to the society an ingenious rubber cell which he has devised for use in mounting opaque objects.

Rev. Myron Adams suggested that at some future meeting the society be given an account of the proceedings of the microscopical branch of the National Science Association, lately held in Boston, by one of their number who had been present. Professor John G. Allen and Miss Frances Cogswell, of this city, were elected active members, and Dr. F. W. Hamlin, of Auburn, an honorary member of the society. The Secretary announced that the following members would be expected to exhibit specimens at the next meeting: C. C. Merriman, Dr. R. M. Moore, A. H. Morgan, W. G. Morse, J. E. Nichols, H. L. Osgood, C. F. Paine, F. D. Phinney, H. K. Phinney, Norman M. Pierce. The members present then gathered about the tables and examined the specimens exhibited under the microscopes. Miss Lattimore exhibited, under a microscope with polariscope attachment, crystals of cholesterine, Henry C. Maine, a beautiful arrangement of diatoms, Mr. McMath, a section of a human tooth. This closed the proceedings of the evening.

The Elmira Microscopical Society.—A regular meeting was held Oct. 9th. President Gleason in the chair. The first lecture of the evening was delivered by Dr. Krackowizer. Subject: "The Histology of the Liver." He described first, the structure of the liver, illustrating with drawings upon the blackboard, the queer entanglement of veins, arteries and ducts that serve for a net-work to hold the liver cells that seemed to be sifted into the interstices; showed how the cells were forced to assume various forms by reason of their environment.

He then spoke of the function of the portal veins and gall-ducts, clearly pointing out how these structures could be distinguished one from the other, under the microscope. The cause of change in these structures was commented upon and effects upon the system noted. He clearly demonstrated how to recognize these changes, and then exhibited numerous slides of liver preparations under the microscope, commenting upon them the while. The lecture was exceedingly interesting and original, eliciting numerous queries from the members, to which the doctor happily responded.

Nine o'clock having arrived, further discussion of the subject was prevented by the announcement of the next paper, entitled "The Amœba," by the

President, Dr. S. O. Gleason. The doctor referred to the amœba as being a "living fluid"—a primitive cell, which had been aptly described as having the ability to move without muscles; to eat without a mouth, and to digest without a stomach, living and thriving without exhibiting any evidence of a vascular or nervous system. He spoke of the pulsating vacuole, and speculated upon its probable significance; whether or no it might not be a possible organ of respiration, producing a sort of circulation and aeration in the protoplasmic mass through endosmosic and exosmosic action. The doctor referred to the fact that the very beginning of the study of physiology, now-a-days, of necessity occurred with the amœba. He compared the amœba with the white corpuscles of the blood, and related how some observers had seen the white corpuscle engulf the red one, appropriating it, apparently, to its own use, as would an amœba feed upon an alga. He then queried: Might not these white corpuscles be *living* cells of protoplasm, differentiated, in some mysterious manner, in the arteries and veins of our bodies, and converted into the different tissues?

After watching the curious movements of the amœba under the several excellent microscopes on duty for that purpose, until eleven o'clock, and the secretary having been appointed essayist for the next meeting, the Society adjourned to the first Saturday in November.

THAD. S. UP DE GRAFF, Secretary.

Illinois State Microscopical Society.—The regular meeting of the State Microscopical Society of Illinois, for October, 1880, was held at the Academy of Sciences, No. 263 Wabash Avenue, Chicago, Friday evening Oct. 8th, the President, B. W. Thomas, in the chair.

The routine business of the evening completed, Mr. W. H. Bulloch described a new stand which he had recently constructed designed especially for lithological work, but which can readily be converted into an instrument suitable for ordinary work. The speaker stated that he used the adjective "new," with considerable hesitation, as his claims in that direction had, in the past, been so strongly disputed. Some features were, however, new to him. These he proceeded to describe. The stage was made to rotate concentrically on the same plan adopted in his large instruments, and was graduated to read, with a vernier, to minutes. Both the mirror and sub-stage were mounted on graduated circles, and arranged so as to swing over the stage, either separately or in unison. The sub-stage was made in two cylindrical fittings. The lower one, carrying the polarizing prism, could be readily swung to one side, while the upper carried the achromatic condenser. The polarizing prism was mounted with a circle graduated to degrees, and was fitted with a stop for marking the position of the prism. The analyzer was mounted above the objective somewhat after the manner of a Wenham prism, and could be slid in and out of position with the same facility, and also carried, if desired, a quartz film. It was, he said, a matter of great convenience for the lithologist to be able to pass from the use of ordinary, to that of polarized light without loss of time, and, with the instrument on exhibition, the change could be effected in less time than a change of objectives with a double nose-piece. The stand was also provided with a goniometer eye-piece, which was fitted with a calc film and analyzing prism, both separable at pleasure.

Dr. Detmars exhibited sections of animal tissue, which, he claimed, were but 1-1500 inch in thickness, and briefly described the instrument used in cutting them. A triangular discussion ensued between Mr. Bullock, Mr. Summers, and the Secretary, which resulted in a promise to exhibit some of the favorite devices at the next meeting. Mr. Beck, of London, who was present, suggested that some of the surplus American ingenuity of the members might advantageously be expended in inventing a section cutter for diatoms.

The Secretary illustrated his method of mounting balsam slides. By the use of very hard balsam contained in a chemist's dropping bottle, a slide could be finished in a few minutes, ready for the cabinet. He also called attention to a peculiar algoid, which had made its appearance in his apparatus for making dialyzed iron, and which to the naked eye, somewhat resembled a nostoc. The water in which it grew was pretty strongly charged with ferric chloride and ammonium chloride and contained free hydrochloric acid.

Mr. Beck was invited to address the society, upon which he made a few remarks, dwelling on the cordial feeling existing between the microscopists of England and the United States. The advantages of the exchange of slides between workers of the two countries, especially to those engaged in the study of certain departments of natural history, and passed to a consideration of the practical uses to which the microscope could be put, such as the examination of potable water, the detection of adulterations, etc.

Mr. H. W. Fuller testified to the exceedingly cordial reception which he received from the microscopists of London during his recent trip abroad, and stated that he found the affairs of the Royal Microscopical Society managed in the most admirable manner, and that it afforded a model which we should emulate.

The meeting was then declared informal.

ERNEST B. STUART, Secretary.

EXCHANGES.

A good microscope, costing $136 in Paris, in exchange for a good working spectroscope. Address "Spectroscope," care American Journal Microscopy, 14 Dey Street, N. Y.

Wanted, a good neutral tint camera lucida, to fit eye-piece, 1.26 inch diameter, for 5 fine slides. Address F. N. Tillinghast, Greenport, Suffolk Co., N. Y.

Lower Silurian fossils from near the Falls of St. Anthony, Minn., for good microscopic material, etc. John Walker, 810 Ave. S., Minneapolis, Minn.

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On the Preparation and Cleaning of Diatoms.

BY H. L. SMITH, HON. F.R.M.S.

MANY persons who have faithfully tried the processes recommended in the books, find, much to their disgust, that after all the trouble and care, there will always, be a large amount of flocculent matter which neither acids nor burning will remove, and which will cause the diatoms to clot together, and make the completed mount a rather dirty object to behold. Turning from their own preparations to those of Möller, and others who may have the secret, they know that there is, somewhere, a knowledge they do not possess, and which has not yet crept into the books. And this is true. I was not myself aware of the remedy until long after I wrote the article, which the editor of this journal copied from the "Lens" into his little book entitled "Diatoms." I have made it known to many, but so far as I am informed, the process I am about to describe has not been published. I do not know whether "Möller's secret" has leaked out, and so has reached me in the course of my extensive correspondence, for it is not my own invention, and, indeed, I cannot now remember just when, or where, it was first breathed to me, for I have known it for some years, but certainly with no "injunction to secrecy." I can assure the disgusted student, who finds his beautiful diatoms, after all the acid treatment, and all the incineration, yet full of flocculent matter, that there is a royal way to cleanness, and after all, the good old way, by the use of soap! In fact, the use of this common and too much neglected article, will produce astonishing changes in cleaning up the diatoms, as well as in cleansing dirty linen. I will describe what I did yesterday—the whole, during one evening, and in fact, except for the waiting for the diatoms to settle, all the process would not occupy over ten minutes. I received a gathering of marine diatoms from the Hawaiian Islands, enclosed in a joint of bamboo, instead of the usual vial. They were dried, and matted, but the gathering was rich in the well known Sandwich Island forms; so characteristic, that I could have told the locality, if I had not already known.

I put the dried material, such as it was, into a large test tube, and covered it well with nitric acid, and left it for an hour, (the time is not material). After this, I boiled it, adding a little more acid, and, dropping in two small bits of bichromate of potassa, again boiled for a minute or two. The tube was now filled with rain water, and the whole mixed by inverting, etc. As soon as the mass (flocculent enough) had settled, the discolored and acid water, was poured off, and the tube was again filled with rain water, (it is better to use soft water). After settling, the water was again poured off, and the deposit once more washed. So far, this is the old method, which generally ends here, only washing out as best one can the lighter forms and broken frustules. A preparation made at this stage, marked (1) on the slide sent herewith, showed plenty of diatoms—principally Synedra robusta, and Rhabdonema mirificum, but also any amount of the flocculent matter, the bane of diatom preparers, and which, from presence still of organic matter, browned in burning; a subsequent washing somewhat improved this, see specimen marked (2). Pouring off the supernatant water, and adding a little clean soft water, I now put into the tube a bit of common yellow soap, size of a pea, and again boiled the deposit for a minute or two, after which the tube was filled with clean rain water. Some fifteen or twenty minutes after, the yet milky fluid was poured off, (it contained but few and very minute diatoms, which one can save if so disposed, by keeping the poured off fluid for a longer time.) The tube, with a heavy deposit at bottom, was again filled with rain water, and shaken, and now a peculiar brilliant sparkling, and play of colors, showed that the flocculent matter was gone, and only clean diatoms, sponge spicules, and possibly some sand remained. Specimen marked (3) shows appearance at this stage, and that marked (4) after one more washing. Finally distilled water and alcohol was added, and after this washing, pouring off all the finer forms which remained in suspension after five minutes, and which were saved with those of the other washings, little else remained except clean diatoms, as shown on the finished slide sent herewith.

If, after this, anyone exhibits a slide of diatoms full of flocculent and dirty deposit, peculiar to the old methods of treatment, (unless, indeed, the original gathering had been an exceptionally clean one), we can only say, as in Miss Edgeworth's nursery story, "What, no soap?"

Pelomyxa Palustris and Evolution.

(Continued from page 228.)

LITERATURE.

(1) The History of Creation. By E. Hæckel. Translated from the German.
(2) On the Origin of Species by Means of Natural Selection. By Charles Darwin, 6th Edition.
(3) The Descent of Man, and Selection in Relation to Sex. By Charles Darwin.
(4) The Variation of Animals and Plants Under Domestication. By Charles Darwin.

We have now become acquainted with a mode of reproduction simpler and more primitive than any hitherto known.

In saying this, I would not have it thought that my reading has been so extensive as to make it absolutely certain that the observations recorded in my last are new to Science. I shall try, however, to keep sharp the distinction between my own work and that of others, so that any one may know on what authority each and every statement rests. If, then, I am so unfortunate as to present for new, things long since known, it is merely my misfortune and can do no harm to Science. For it is an advantage that old discoveries should be kept fresh by many repetitions, especially when the repetitions represent original work.

Of course, we may have "too much of a good thing," nor would it be either pleasant or profitable for one to announce now the discovery of "fission" or of "conjugation" as a new mode of reproduction. These, at least, are things well known, and their importance in the philosophy of Biology has long been acknowledged.

But with *pseudogemmation*, as I propose to call this "simplest known mode of reproduction," it is quite otherwise. Thus Hæckel writes (1) as though reproduction by fission, or self-division, were not only the simplest known mode, but the simplest thinkable.

The relation of *pseudogemmation* to Darwinism is very simple, so simple that a few lines might easily dispose of this part of my subject. But I cannot assume that the reader knows exactly what Darwinism is, as I have had the greatest difficuty in determining that point. Even now, after careful search through that small portion of the "literature" accessible to me, I cannot say that I *know*, beyond a doubt, what theory Darwin meant to propound. And yet I have read, more or less carefully, (1) (2), (3), and (4), and, with less care, the writings of Huxley, Mivart, Wallace and Schmidt, to say nothing of numerous short essays in various places. It is, to me, a matter of no little astonishment, that I have not, as yet, been able to find a statement of the Darwinian theory of evolution so clear that it could not fail to be understood. I suppose, therefore, that no one will object to the following presentation of the theory, as I understand it.

There is a minute species of the genus Amœba, which has two forms, A and B. A is of no constant shape, having an irregular outline. It moves from place to place with extreme slowness, and in no constant direction. B has a constant shape, with a regular outline. It travels with great rapidity and in a straight line, changing, now and then, its direction of motion. Every individual of the species has, apparently, the power of assuming either form at any time, and I know of nothing more curious than to see this transformation of an inert, formless lump of protoplasm into an active form which has every appearance of possessing consciousness and will.

The individuals of this species are not all exactly alike. Without doubt some spend more, some less of time, in shape b. Let us represent those individuals which spend about half the time in the b form by $b\,a$, those that spend about twice as much time in b as in a, by $b^2\,a$, etc; and let us suppose that the species has a sexual reproduction of some sort. The problem is to get, from the action of the "conditions of life" upon the individuals constituting the species, a new species. For the sake of simplicity, we will suppose that the conditions of life are everywhere, and at all times, the same.

There is no need of my saying anything concerning the "struggle for life." Just what the term implies is well known.

Suppose that those individuals of our species having a stronger tendency to assume and keep form b are thereby made better able to survive in this struggle. In other words, let b be superior to a. Then the time will come when form a will no longer exist, and this is equivalent to the formation of a new species. The reasons for this are few and simple. At a certain time there will be found, we will say, only individuals represented by $b^2\,a$ (This, in nature, would never occur, but only an approximation to it. It is simpler, however, to make the assumption.) This result has been brought about simply on account of the conditions of life having been too unfavorable for the existence of those individuals in which a occurs more than half the time. *Thus then there is brought about a mating of individuals represented by $b^2\,a$.* Had there been no "struggle for life," this mating might never have occurred. If $b^2\,a$ represent a tendency towards b stronger than the normal, then $b^2\,a$ is a variety, and the struggle for life has brought about a *mating* of those individuals which have varied in a certain direction. By this means we have secured the *certain perpetuation* of the variety. For had there been no wholesale destruction of the less favored individuals, $b^2\,a$ might have united with $b\,a$ or with $b\,a^2$, and the chances for the preservation of $b^2\,a$ would have been less good. It is said also that by the union of $b^2\,a$ with $b^2\,a$ we get a tendency to variation in the direction of $b^3\,a$, but the causes of variation are, I think, no part of the theory of Darwinism, and we may, therefore, disregard this more or less important factor. Among the descendants of $b^3 a$, there will be found in the course of time, many $b^3 a$'s, and these will mate and perpetuate their peculiarities just as was the case with $b^2 a$. And so we get, gradually, $b^4 a$, $b^5 a$, $b^6 a$, ... b. In this process of evolution each step is simply a repetition of the first which may be, in general terms, thus described.

The individuals of a species are not all alike; some are better able than others to endure the constant struggle for life, and these, for that very reason, will often be compelled to mate with each other. In this manner the *preservation* of every favorable attribute that may arise is secured, the accumulation of such attributes constituting, from time to time, a new species.

This is Darwin's theory of natural selection as I understand it. It cannot be too well understood, however, that the only element of explanation in this theory is the fact, more or less probable, that Nature, by destroying certain individuals, compels the mating of others. And yet I do not know that I have ever seen it stated, explicitly, that such mating is an essential part of Darwinism.

Any attribute not possessed by the typical individual of the species, I would call for convenience, a variant. The great merit of Darwinism is this: it shows why these variants are not lost almost as rapidly as they occur. If we represent the individuals having a certain variant by *A*, there is always some danger of *A* mating with non-*A*. Darwin has shown how this danger may be reduced to the least possible.

But in the case of the first organisms there is no such danger to be overcome, since these forms had nothing like a sexual reproduction. There is here, therefore, no place for Darwinism, which first begins to be of use with the dawn of sexuality. To return to our Amœba; we have only to suppose that there is never any union of individual with individual, or that such union, as is probably true of *Actinophrys sol*, has no reproductive significance; and Darwinism at once becomes useless. There is nothing for it to explain. We would get the steps $b\ a$, $b^2 a$, $b^3 a$, $b^4 a$, ... b, by a simple process of variation, inheritance, variation, inheritance repeated over and over again, and any variant that might arise would be preserved, or at least there would always be a strong tendency in that direction.

It seems, therefore, probable that many species, low down in the scale of life, have been evolved without any aid from natural selection. In fact Darwin admits the possibility of such evolution, even for species the most complex, and I am inclined to think Mivart right in saying that the importance of natural selection has been greatly over estimated.

I had, at first, no intention of writing more than a few lines concerning Darwinism, but, now that these lines are written, it can do no harm to add to them a few more. Moreover, I cannot help thinking that evolution is a topic always in order, so great a problem is it; not perhaps, as yet, of any direct importance to man, save as it is more or less closely connected with religious creeds, but it is the one problem of Biology, and beside it all other biological questions sink into comparative nothingness. But to the great number of almost worthless essays upon this problem I do not care to add another, which feeling, however, is of no weight against the insertion here of a very short account of views which are perhaps, peculiar, and worthy, therefore, of some little consideration.

It cannot be too well understood that Darwinism is far from being identical with a certain theory of evolution which seems to me to be more certainly true than can well be the case with Darwinism, and which it would be not easy to trace to any one man as its originator. This theory does not aim at an *explanation* of the great fact of evolution, assuming this to be fact, but it concerns itself solely with the effort to demonstrate the general theorem that all organisms *have* arisen from certain "first forms," which were so simple in structure and in general mode of life as to be not very greatly different from inorganic matter. *This theory is the result of the attempt to explain the fact of similarity, or partial agreement, everywhere present in organic nature. Darwinism is the result of the attempt to explain the equally ever present fact of dissimilarity or diversity; the astounding variety of organic nature.*

Organisms agree in certain particulars. These agreements are of so diverse a nature that it is improbable that they can all be referred to one cause. But let us confine attention to those striking agreements found to exist between organisms very unlike in many respects, (birds and dogs for example) and which will not only bear the closest analysis, but are found to be the more perfect the more perfectly they are analyzed. If now we try to explain such facts of agreement, we can only do so by supposing that the forms exemplifying them had a common ancestor. So far, all is clear and we may say at once that the last proposition is probably true. For so long as we know of nothing *against* a hypothesis which is capable of explaining certain facts, we are bound to accept, for time being, such hypothesis as probably true. By this simple process, modified somewhat as the field of investigation changes, we arrive at the conclusion, more or less probable, that all organisms have descended from one or a very few common ancestors. No man, however, would be perfectly satisfied with this much of evidence. He would desire to test the conclusion by an appeal to experience in every department of Science. Very much of this work has been done, and in time we may come to feel as certain of our conclusion as now of the proposition, also merely probable, that a stone, unsupported, will fall to the ground. But in my opinion, that piece of evidence which will ever remain of the greatest importance is the fact of agreement with which we started. When, therefore, Darwin writes (3): "He who wishes to decide whether man is the modified descendant of some pre-existing form, would probably first inquire whether man varies, however slightly, in bodily structure and in mental faculties; and if so, whether the variations are transmitted to his offspring in accordance with the laws which prevail with the lower animals. Again, are the variations the result, as far as our ignorance permits us to judge, of the same general causes, and are they governed by the same general laws, as in the case of other organisms; for instance, by correlation, the inherited effects of use and disuse, etc.? Is man subject to similar malconformations, the result of arrested development, of reduplication of parts, etc., and does he display in any of his anomalies reversion to some former and ancient type of structure? It might also be naturally inquired whether man, like so many other animals, has given rise to varieties and sub-races, differing but slightly from each other, or to races differing so much that they must be classed as doubtful species? How are such races distributed over the world; and how, when crossed, do they react on each other in the first and succeeding generations? And so with many other points. He would have done better to say: "He who wishes to decide whether man is the modified descendant of some pre-existing form, would probably first inquire whether man *resembles* closely the lower animals." In the conclusion, however, of the noble work referred to (3), Darwin states the case more to my satisfaction. "He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. He will be forced to admit that the close resemblance of the embryo of man to that of a dog, for instance—the construction of his skull, limbs and whole frame on the same plan with that of other mammals, independently of the uses to which the parts may be put—the occasional reappearance of various structures, for instance, of several muscles, which man does not normally possess, but which are common to the Quadrumana—and a crowd of analogous facts—all point in the plainest manner to the conclusion that man is the co-descendant with other mammals of a common progenitor."

Having now explained certain facts of agreement, we may seek an explanation of those facts of disagreement which constitute the "astounding variety of organic nature." Now that we are convinced of the truth of specific evolution, the important question arises; what has caused such evolution? Of this problem Darwin has given a partial solution, and it is this solution which I have called Darwinism, not pretending, however, that Darwin has not very greatly aided in the solution of that other and perhaps more important problem which, concerned at first merely with the similarities of organisms, has resulted in an almost universal acceptance of the general fact of evolution. This fact, if I may call that a fact which is not certain beyond the shadow of a doubt, is not greatly affected by either the truth or falsity of Darwinism, so that, as a student of similarity, caring little for dissimilarity, I care little whether Darwinism be true or false.

In any case it is a solution which does not in the least apply to that department which is, perhaps, of the greatest philosophical importance, the department of the lowest forms. But what proof have we that such "lowest forms" as philosophy demands for a starting point, ever existed? May not the very first forms have had a sexual reproduction? Thus far it has almost always happened where a species has been subjected to prolonged investigation, that some sort of sexual reproduction, or something very like it, has been found to be an essential factor in the life of the species. Since, then, such experience as we have is against the hypothesis of non-sexual organisms, the discovery of *pseudogemmation* appears to be quite fortunate. For it will be, perhaps, forever impossible to prove, of any species, that it certainly is non-sexual, and the most that can be done is to discover modes of reproduction so simple as to remind one forcibly of the time when reproduction of any sort was unknown. I admit that this kind of evidence is not most satisfactory, but it is likely to be the only evidence, aside from philosophical considerations, that the near future can produce.

No one will deny that Hæckel's discovery of the *Monera* was of considerable importance to the general theory of evolution. But the *Monera* of to-day are not by any means such simple organisms as were, according to our philosophy, the first forms of life: and yet, they are evidence for these first forms, because they remind us of them by being so very simple. If it be asked how this can be thought evidence, I would answer that it is the verification of an inference from the hypothesis. For if the first forms really were sexless, organless, and without any power of reproduction, and if from these forms all other forms have come, then ought we to find some trace of their past existence in the shape of forms very simple, and of factors, in the life of less simple forms, which resemble closely factors in the first forms or in their early descendants. Such a factor is pseudogemmation. I am inclined to think that we have also in Pelomyxa another "factor," for that an animal should swallow sand enough to be called a "bag of sand" seems sufficiently primitive.

W. G. Lapham.

To be concluded.

Shellac Cells.

PROFESSOR H. L. SMITH having condemned the wax cell, has endeavored to find a substitute, and strongly recommends cells made of shellac. In a recent number of *Science*, he thus describes his method of making these cells:

> The preparation of the shellac rings by the turn-table obliges one to keep on hand a large stock all the time to insure perfect drying, and to have them always ready. I am obliged to have some 1,000 or 1,500 on hand in advance, and this necessitates a considerable outlay in stock, which will not always be convenient for amateurs. For the above reasons I now propose a new process which appears to meet all the desired wants, and which combines the ad-

vantages of the shellac cement and the gutta-percha rings.

The very simplicity of this process causes me to wonder why it was not thought of before. I take a sheet of thin writing paper, white or colored, and dip it into thick shellac varnish (shellac dissolved in alcohol), and hang it up to dry. When thoroughly dry it should have a good glaze of the varnish on it (different thicknesses of paper can be used according to depth of cell required). Out of this shellac paper I cut my rings, and these can be made in any quantity, and kept for any time. The process of mounting is simple. The slide is cleaned, and the flat paper ring placed in the centre; on this the cover is placed, having the object dried on it, and the two are held together by the forceps and gently warmed; this serves to attach the ring to the slide, and cover, at several points, so that the forceps may now be laid aside. The next step is to take a glass slip, (another slide), and laying this on the cover, to grasp the two slides at each end by the finger and thumb of the two hands, and pressing them tightly together, to warm the slide gently; by looking at the ring obliquely, on the under side, one can tell at once, when all the air is pressed out, and the adhesion is complete between the cover and the ring, and also the ring and the slide, and they must be held together a moment or two to cool. If the lac is sufficiently thick on the paper the adhesion takes place quickly, and with moderate heat, and there will be no danger of breaking the cover, unless it has been warped in the process of warming, which will sometimes occur when very thin glass has been heated too much for the purpose of burning off the organic matter, or when the support is too small in diameter, or when it is not flat. I think I may be able to induce the leading opticians to manufacture this paper and also the rings for sale; for special purposes the paper might be printed beforehand, so that, when mounted, the ring would show on the under side the name of the preparer, or of the object. I cannot conceive of anything more satisfactory than these rings. Many large objects which would be crushed if one used only the shellac rings made on the slide, by the use of the turn table, by the giving way of these by softening, and under the necessary pressure for attaching the cover, are perfectly protected by the paper rings. I am satisfied that the balsam mounts will be much less frequently used, as soon as we can find some *sure* dry process. The diatoms, as a rule show much better when mounted dry, and with whole frustules, exhibiting both the side and the front view, also the mode of attachment, etc. The dry mounts are certainly to be preferred when they are desired for anything except pretty objects, and even for this latter purpose there is often a very great difference in favor of the dry mount. Although I have not used these shellac paper rings for any very great length of time, yet I can see no reason why they should not be equal to the simple shellac ring for durability, and very much superior to it in other respects.

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The Minute Forms of Life in the Waters of the Lakes.*

AMONG all these varied forms of teeming life with which the lake water abounds, there are none, so far as I know, which might not be expected to be found in fresh water, except among the diatoms. But of the sixty odd species of diatoms which are found in the filterings of our water supply, there are at least three, and perhaps more, which are representatives of marine forms; these are the Rhizosolenia eriensis, Actinocyclus niagaræ and Amphiprora ornata, and to these should be added, in my judgment, the Stephanodiscus niagaræ.

Of these forms the Rhizosolenia eriensis was first collected by Mr. H. C. Gaylord from the water supply of this city, and was described and named by Prof. H. L. Smith, of Geneva, N. Y. This is the only species of Rhizosolenia yet found in fresh water, all other species of the genus yet described being marine or fossil, and the recent forms mostly found in the stomachs of salpæ and ascidians. This diatom has so far only been found, to my knowledge, in the waters of the lakes at Cleveland, Buffalo and Chicago. The Amphiprora ornata, found in considerable numbers in the lake water at certain seasons, has also been reported from two other localities in Ohio, from New York and from Florida, but sparingly. The Actinocyclus niagaræ, named by Professor H. L. Smith, and described in the *Ameri-*

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* Extract from a paper read before the Kirkland Society of Natural Sciences of Cleveland, Ohio, by C. M. Vorce, Esq.

can Quarterly Microscopical Journal, October, 1878, was also sent to him by Mr. Gaylord, and has not yet, so far as I can learn, been reported from any other locality than Cleveland. The other species of Amphiprora are marine, and those of Actinocyclus marine or fossil.

Some other species of diatoms found in the lakes are so modified in form as to be perceptibly different from the same typical species .found elsewhere. From these facts Prof. Smith, above named, suggested the query whether salt or brackish water might not be found at the bottom of the lakes; but from the shallowness of Lake Erie that is improbable in this case, and my own conclusion is that these forms of diatoms are survivors of the ancient sea, which have, during the subsidence of the former sea, survived the change through brackish to fresh water, perhaps not modified in form during the change. As bearing upon this view, many facts which have come under my observation may be cited. Some three or four years ago, after repeated desultory examinations of the lake water, I began a systematic course of taking filterings, and at first supposed that filterings of each of the four seasons of the year would display the species of the year; but during the second year of such observations I became convinced that more frequent tests were needed, and took filterings from twice to three times per month, and during the year 1879 I saved a filtering of each week of the year, except during two short absences. Examination of the filterings when taken confirmed what had been deduced from former observations, that the forms of life in the lake water exhibit a well marked periodicity, the limits of which I have not continued the observation far enough to exactly define at present, but which as far as the diatomaceæ are concerned, can be in general terms stated thus: During that part of the year from about the first or middle of February to about the first of May, the variety of form is greater; from thence to about November 1 the abundance of the prevalent forms is greatest, and from November 1 to about February 1 the disappearance of warm weather forms and appearance of the cold weather forms goes on; thus producing a periodicity of three seasons in the year. During the winter and the early spring the Stephanodiscus niagaræ is the prevalent form, giving place to Melosira crotonensis as the warm weather approaches, which soon yields prominence to Tabellaria fenestrata, which continues the predominant form until fall, when the Melosira again appears, and soon becomes equally numerous, both forms, as cold weather approaches, becoming scarcer, while the Steph-niagaræ reappears and rapidly increases in numbers, until at times it forms almost the whole of some winter gatherings. The Actinocyclus niagaræ, so far as can yet be judged, appears most frequently in the late winter and early spring gatherings; seldom or never in summer. The Amphiprora ornata and Rhizosolenia eriensis are found occasionally at all seasons, but in greatest abundance in the winter and early spring gatherings. During some weeks in July and August, 1879, neither of these diatoms were found, the gatherings consisting almost exclusively of Tabellaria fenestrata. The forms of Surirella and Cymatopleura are also most abundant in the early spring gatherings.

The influence of storms on so shallow a lake might well be supposed to have considerable influence upon the contents of the water supply, but so far as I have been able to observe, no difference in the forms of diatoms found in the filterings is caused by storms, but considerable mud is brought with them.

This periodical abundance of the forms before mentioned, the Actinocyclus, Rhizosolenia and Amphiprora, in the colder season, and their partial disappearance in the hottest season of the year, and the uniform greater abundance of the Stephanodiscus during the winter, also becoming scarce in summer, is strong evidence, in my mind, that all these forms are survivors of the cold seas, and were, perhaps, the chief forms then prevalent in those waters; for which reasons the colder temperature of the present lakes is most congenial to them and best suited to their development.

As the changes that left our present lakes progressed, these forms kept pace in their modification with that of their habitat, new forms appearing and being introduced by various causes, until the present condition has been reached, and I entertain no doubt that if future changes should replace our lakes with Arctic seas, these peculiar diatoms would then be found the chief and perhaps the only survivors of our numerous present forms.

It may be of some interest to state that in the year 1878, at the suggestion of a gentleman in Philadelphia, I sent to him repeated gatherings of diatoms from Lake Erie with a view of introducing the Stephanodiscus niagaræ into the fresh waters and clear spring ponds of that locality; but we did not succeed in getting them to live, although they will live for weeks here in a comparatively small amount of water.

Another matter should be mentioned, and that is that the character of the filterings taken on the same day varies in different parts of the city. I have seen forms of diatoms and infusoria quite abundant in a filtering made at the store of Mr. Gaylord, which forms could not be found at all in a filtering which was progressing at my own house during the same time, and other striking instances have been noticed; but as the periodicity of forms is a characteristic always observable wherever the filterings are taken, it may be assumed that a continuous series of observations made upon filterings from the same faucet, represents fairly well the characteristic of the general source of supply.

It would be of much interest to supplement the examination of the contents of the water supply with that of dredgings or soundings from the sediment of the lake bottom, and I hope eventually to be able to do this.

The Termination of Nerves in Muscle.

A MEMOIR on the interesting subject of the mode in which nerves terminate in muscle is contained in the part of the *Archives de Biologie* that has just been issued. It is from the pen of M. Foettinger, who has been engaged upon the subject for four years, and who has conducted his researches partly in the laboratory of M. Edouard v. Beneden in Liège, and partly in that of M. Engelmann in Utrecht. The muscles of insects were selected in preference to those of other animals, since the details of their structure are more easily recognisable under the microscope than those of other groups of the animal kingdom. The best preparations were obtained from the Chrysomela cærulea, a beetle which is common on various labiate plants, especially on the mints, from Hydrophilus piceus, Lina tremula, and the Passulus glaberrimus. The animals were placed in strong alcohol for some days, and the isolated fibres of the legs or trunk examined with various powers. Each fibre or primitive fasciculus presents several nerve-endings. In Chrosomela nine were sometimes found in the length of one millimetre, though this was an unusual number. In Passulus as many as five were found in one millimetre and a half, and in Hydrophilus six were found, in one fibre. There seems to be no very definite rule either as to the part of the muscular fibre on which they are placed, or as to the number of muscle elements intervening between two of them. Sometimes their position is linear; at others they appear to be placed on opposite sides of the muscular fibre, whilst taking five of them successively it was found that the number of muscular elements between the nerve endings was 23, 13, 21, and 14. These are usually conical in form, a nerve running to the summit of each cone. The cone itself is composed of granular matter, with nuclei interspersed through it, and it sometimes appears as if the granular matter was obscurely segmented into portions surrounding each nucleus.

The nerve-endings or terminal plaques, as M. Foettinger calls them, are situated on the surface of the fibre, and their free surface is covered with a thin, structureless, transparent membrane, continuous with the sarcolemma of the muscular fibre on the one hand, and with the sheath of Schwann investing the nerve fibre on the other. The drawings which accompany the memoir exhibit the plaques as simply applied to the muscular fibre, no processes or fibrillæ penetrating it. He has noticed the interesting fact, which, however, had been previously noted by Arndt and Fredericq, that in insects at least, contraction always begins in the muscular fibre at the plane of the cones, and at these points exclusively, and this fact may be shown to have an important bearing on the subject of *vis insita* of muscle. For since in microscopical specimens the transverse markings of the muscle are always found much more closely approximated just beneath the nerve-ending than elsewhere, it is reasonable to suppose that if a nerve-paralysing agent like curara were administered to the animal, and if the effect of this agent were really, as is usually admitted, on the intramuscular portion of the nerve, the transverse markings should not present the approximation in question beneath the cone alone, but at any part of the contracted fibre indiscriminately. Unfortunately insects cannot be rendered motionless by curara. The point may perhaps be worked out with better success with the muscles of mammals.—*London Lancet.*

The Journal for 1881.

NOTHING has gratified us more than the success of the JOURNAL during the past year—1880. At no time since the commencement of its publication have we received more kind and pleasant letters, or more substantial aid in the way of subscriptions. Our list is to-day larger than it ever was even in the times when our subscription rate was but 50 cents per year.

One reason of this, undoubtedly, is the very large amount of valuable matter which we have given for a very moderate sum. The volume for 1880 contains 276 large and closely printed pages, besides six full page engravings printed on tinted and extra finished paper.

We can assure our readers that we appreciate their earnest and steady support of our efforts to make a journal, which, while within the reach of every one, would be trustworthy and valuable, alike to beginners and to experienced microscopists. No journal could have possibly received more emphatic testimonials of approbation, than have fallen to our lot. We can therefore promise our subscribers a better journal than ever during 1881. As it has been conducted during the past, so will it be in the future. We have assurances of substantial aid from many of our most prominent workers, and whenever it becomes necessary to add to the number of our pages, in order to give our readers an important article of unusual length, whether original or selected, we shall always be ready to do so.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Tin-foil for Cells.

Ed. Am. Jour. Microscopy—At your suggestion, I procured tin foil of various thicknesses for cells, and the result has been so satisfactory to me that I write to tell you of it. I got three thicknesses of foil, and made cells of each, of which I enclose you samples. At first I simply punched them out, using two sizes of gun wad punches for the purpose. But I found it difficult to make the two circles concentric, and unless the cells were quite wide it was not easy to use them, so I have lately proceeded in the following manner, and with the success shown in the samples sent you: I punch the outer circles a trifle larger than I wish the finished cells to be. I then chuck a lot of them on a mandril which exactly fits the hole, and turn down all at once to the intended size. It is but a few minutes work, and any tinner can do it. It leaves a beautiful finish on the outer edge and the two circles are exactly concentric. The cost to me, if I have them made for me, is about 75 cents per hundred for the finished cells, unless they are very thick, in which case the tin foil is so much heavier as to add a little to the cost. They are cheaper than any cell I have seen for sale, and less trouble than any other I can make. The wax cell, and indeed wax in all its forms in mounting, I gave up a year ago or more. The tin cell is not affected by any of the fluids used in mounting, and when fastened to the slide with shellac varnish, which I always thicken with Chinese vermillion, seems to me a permanent fixture, if any cell can be made so.

ALBERT H. CHESTER.

Chemical Laboratory, Hamilton College,
November 15, 1880.

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AND
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Important Notice.

We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II, III, and IV, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

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Our Number for January, 1881.

THIS number is in a forward state of preparation, and contains some very able and interesting articles, amongst others a paper on Vegetable Hairs, by Dr. Stokes, of Trenton, with a full page illustration, containing twenty-eight figures, engraved by Cuzner, whose work in this direction is known to be unequalled. Also a paper of great value by Dr. Lockwood on "Abnormal Entozoa in Man." We shall also give a full page engraving and a very able article on the rhythmical waves, visible in the strokes of writing under various circumstances. Altogether our opening number will prove exceptionally interesting.

Trichinosis—Science in Commerce.

AN interesting case came before the Brooklyn Courts some time ago. Mrs. Eliza Greifelt sued Figge Bros., for $5,000, for the death of her husband which was alleged to have been caused by trichinosis produced by certain infected hams, purchased from the defendant. A verdict was rendered for the defendant, but this was due, we believe, to the fact that a good deal of doubt was felt in regard to the ham's being the real cause of the trichinosis which caused death. That the ham contained trichinæ, was abundantly proved, but it was also in evidence that the time between the ingestion of the ham and the appearance of the symptoms was too short to allow of the development of the trichinæ from the ham, and therefore it was supposed that the particular trichinæ which caused the difficulty, came from some Cincinnati sausage which had been eaten a short time before. The point of greatest interest, however, lay in the judge's charge. In addition to the usual points regarding clearness of proof as to the fact that the patient actually died of trichinosis, and that the trichinosis was due to the eating of this particular ham, the judge charged that "in trade, persons were only bound to use ordinary care and skill," and not the most scientific precision. He also charged that the jury must say whether it was an ordinary custom to eat raw meat, as it was a reciprocal duty to use food in the ordinary way.

These are points of great importance in many commercial dealings, and no doubt affect questions of adulteration quite as much as cases of what may be called deteriorated food or other goods. But it is evident that that which is extraordinary care and skill to-day may become but common care and skill to-morrow. From the testimony presented in this case, and from numerous recent reports, it is evident (1) that a considerable percentage of our hogs are infested with this parasite; (2), that the existence of trichinæ in any meat, forms a real source of danger, and (3), that the use of the microscope forms a certain means of ascertaining the existence of these parasites. Now the use of the microscope for the purpose of detecting trichinæ, is easily acquired, and such an instrument as is absolutely necessary, need not be costly—say not more than $5 to $10. Therefore, the next time such a case comes into court, it will be a serious question whether or not dealers are justified in neglecting a proper examination of the meat that they sell.

We see in the report of this case that Mr. Atwood, who, in connection with Dr. Belfield, made the extensive examinations of pork in Chicago. was called to the stand, and testified as to certain general facts in connection with trichinæ. Unfortunately, we have at hand only a newspaper report of the trial, and every one knows how liable such reports are to be in error. We notice, however, that Mr. Atwood says he has found trichinæ in the flesh of chickens, something which is contrary to the experience of Dr. Cobbold, who tried in vain to obtain a specimen of the trichina from the flesh of chickens which had been fed with trichinous meat. Mr. Atwood also doubts the importance of the *role* usually attributed to the rat in the diffusion of trichinæ.

Sound knowledge in regard to the diffusion and propagation of trichina are at this time very important, and we believe that if the knowledge at present at our command, were properly applied, trichinæ might be stamped out of existence. In opposition to the views of Mr. Atwood, however, careful study and examination has led us to hold to the old doctrine that the rat is the great carrier. This might at first sight seem to preclude all hope of stamping out trichinæ without first stamping out the rats, for every one knows that rats will frequent pig pens, and that each hog probably eats not only one rat but many of these vermin. But the rat first acts as a *collector* of trichinæ, and this it does by eating the offal of hundreds of oxen. The oxen in turn obtain trichinæ from infected water, and from grass which has been fertilized by slaughter house manure. The number of trichinæ existing in any one ox is never sufficient to produce disease either in the animal itself or in those who eat its flesh. Consequently the rat eats the offal from such animals with impunity, but living for a long period in the slaughter house, it finally becomes thoroughly infested with the parasite, and when at last it falls a victim to some active pig, the latter animal gets a dose which renders its flesh fatal to the next devourer in the series.

Of course, the pig itself may act as a collector, gathering up the trichinæ from oxen and from other pigs, multiplying them by the thousand by the natural process of generation, and finally offering to its human devourer in one fell dose, the accumulated gatherings of months of foul feeding.

Fortunately, however, so far as human food is concerned, a simple and easily applied remedy is at hand. This consists in thorough cooking, for no thoroughly cooked meat can possibly contain living parasites.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Royal Microscopical Society.—The second meeting of the session of the above named society was held at King's College on Wednesday evening, Nov. 10th, Dr. Lionel Beale, F.R.S., (President) in the chair.

The minutes of the last meeting were read and confirmed. The donations announced included specimens of diatomaceous earth from Richmond River, New South Wales, by Prof. Liversidge, and from Santa Monica, by Mr. Hanks, corresponding Fellow of the Society; Part 2 of "Belgian Diatoms," by Dr. H. Van Heurck.

The President called upon Dr. Carpenter to exhibit and describe a new microscope.

Dr. Carpenter, whose rising was cordially received by the meeting, said he had much pleasure in bringing before the notice of the Society what he considered to be one of the most practical and efficient Student's Microscopes that he had ever seen.

Taking the microscope in hand, Dr. Carpenter explained that it was made by Mr. George Wale, of New York. The principal novelty was the plan of suspension, by which the inclination of the microscope did not diminish its stability; this he showed in action. He stated that the usual Students' Microscopes were mounted sometimes on one foot by a simple pinion, or more generally on a pinion between two feet; the feet sometimes being built up of metal plates suitably shaped and fitted together, or made of turned pillars attached to a solid base; or again, in one solid casting of iron or brass of more or less convenient design. In the small stands he had hitherto seen, the construction generally involved either expensive workmanship or defects of design, which were serious drawbacks in a microscope intended for popular use. A microscope intended for medical students should, above all things, possess simplicity of design and workmanship; in other words, should be capable of being produced in large numbers at a moderate cost. It should be of substantial build, not easily getting out of order. The focussing movements should be well enough contrived to permit the occasional use of high powers, and the mirror should be so attached as to allow the largest range of oblique motion. These points had been attended to with success in the stand he exhibited. The base consisted of two symmetrical castings of iron, held together at the heel by a small pin fitting in a notch, and by a screw-pin passing through both portions of the uprights, between which the limb of the microscope was held. Nothing could be simpler than this foot; he had examined it carefully, and had found the amount of hand-labor involved in its construction was practically a minimum. The limb had grooves on either side—grooves which were in the original casting—made in the form of a sector of about 90°, and into these grooves fitted corresponding projections, cast at the upper ends of the two foot-pieces; this simple combination of two cast grooves in the limb sliding between the projecting fillets cast on the feet, produced an excellent and convenient motion of inclination of the stand. The clamping-screw at the side had only to be slightly turned, and the limb would then slide easily into any position of inclination from the vertical to the horizontal, and as this motion in the arc of a circle carried forward the lower portion of the limb with its attachments, the centre of gravity was much less changed than by the usual inclining motion on a pivot. He could not but regard the increased stability gained by this motion in arc as of very great importance—as being a quality in which most of the small-sized stands and, indeed, most of the large stands also, were defective. It might be supposed at first sight that mere cast metal-work would produce unsatisfactory motion; but it was not so in this case. The unscrewing the clamping-screw allowed sufficient free play, and the motion, though, of course, not so smooth as might be obtained by machine-cut grooves, was practically as good as could be needed. The focussing was by means of a double slide; the one with rack and pinion for coarse adjustment, the other by the usual fine screw acting upon a lever—a system of focussing that had met with much favor in America, and which he had found successful in practical work. The draw-tube sliding in the optical body was also fitted with the Society screw at the lower end, thus enabling the worker to use 3in. or 4in. objectives for dissections, etc.

Dr. Carpenter drew special attention to the attachment of the mirror, allowing an easy vertical motion, besides a lateral swing giving great obliquity. He next remarked upon the utility of the application of the "iris" diaphragm, which, in his opinion, was a most important adjunct to the Student's Microscope. He had personally found it most useful, in the class of work in which he had been engaged, to be able to watch the effect of the gradual diminution of the diaphragm. The gradation of diaphragms provided by the usual revolving plate of apertures did not, in his experience, meet all the requirements of even low-power work. The "iris" provided admirable means of regulating the amount of light. He explained and figured the construction of the "iris" applied to the new microscope: it consisted of a thin cylindrical tube of elastic metal, about half an inch in diameter, snipped down at short intervals round the edge of one end; by screw pressure of this cut cylinder into a truncated conical box the elastic strips were forced to overlap, and the pressure being continued, the overlapping gradually reduced the size of the opening to a minute aperture, which expanded again to about a quarter of an inch on being released by unscrewing; the truncated end of the conical box, when in position beneath the stage, was very nearly on the level of the upper surface of the stage; as the expansion and contraction of the elastic metal plates cut in the cylinder took place only just below the surface of the stage, the action as a diaphragm was in the most favorable position—as near as possible to the object. Dr. Carpenter thought the "iris" devised by Mr. G. Wale the simplest he had seen, and its cost would probably not exceed a few shillings. He also noted that the stage-clips could be fitted to hold the object either *on* the stage or *beneath*, and that they were made to rotate in a narrow groove near the edge on either face of the stage.

Dr. Carpenter concluded by warmly commending the stand to the notice of the English opticians, saying that he did not at all desire to see a mere copy of the stand produced here, though he thought that might be done less expensively here than in America. He hoped the practical points he had mentioned would be duly considered by our opticians, and that they would endeavor to embody these points with such other modifications as would be found improvements, without adding to the cost. He himself had worked much with the Ross-Zentmayer swinging sub-stage, and had found it very serviceable. He would like to see such an appliance, or its equivalent, applied to Students' microscopes. There was a large field open to any optician who would accomplish the task of providing a thoroughly substantial and practical stand at a low price; that was what students required. Mr. George Wale had here developed some excellent practical ideas. He (Dr. Carpenter) was very glad of the opportunity of commending Mr. Wale's efforts. The Americans appeared lately to have made great strides in the manufacture of microscopical appliances. He believed that Tolles' "amplifier" was a serviceable device, and that it would be found especially of use to the biologist; it gave great facilities for obtaining an immediate increase of magnification without the trouble of changing the objectives, with the attendant inconvenience of readjusting the illumination, etc. It did not matter from whence improvements came—whether from France, or Germany, or America; in all cases it behoved the optician to endeavor to improve the means at our command. The popularisation of the microscope, not only as an instrument of research, but also as an intellectual amusement, had long engaged his attention. His recollection of the microscope extended back half a century. He had followed its improvements step by step, from the days when the stands were indeed primitive and inconvenient, down to the present moment, when the most perfect mechanism was brought to bear upon its construction, resulting in the beautiful specimens of work, many of which had been recently exhibited at the Society. He would not discourage the construction of elaborate stands; in the hands of skilled manipulators, no doubt, very extraordinary results, both of resolution and definition, were obtained—results that could not be got with inferior means; at the same time, he was glad to be able to inform the meeting that on Wale's stand, which he had just brought before them, he had obtained excellent resolution by oblique light on many of the better known test-objects, which he attributed to the convenient arrangement of the illuminating mirror, permitting the light to be easily focussed on the object up to a very high angle of obliquity. Dr. Carpenter thanked the meeting for the attention accorded to him, and resumed his seat amid loud applause.

The President, in rising to propose a vote of thanks to Dr. Carpenter for his interesting observations, said he highly appreciated the necessity of providing a good and cheap form of Student's Microscope. Dr. Carpenter's remarks on the importance of stability should be carefully weighed by the opticians. There had certainly been a tendency to neglect stability. He (Dr. Beale) was sure the meeting would desire him to convey a special vote of thanks to Dr. Carpenter, whose well-known efforts to popularise the microscope had been so continuous and effective during a long period.

Mr. James Swift then exhibited and described an improved form of *Carlotte* diaphragm, consisting of a series of small circular apertures to be applied *above* the achromatic condenser immediately beneath the object, and on a level with the surface of the stage. [Our contributor notes that similar diaphragms have been applied for some time past by Mr. Zeiss, of Jena, to his Travelling Microscope, but they do not act quite in the plane of the stage, nor are they applied in combination with the achromatic condenser.]

Mr. F. Crisp (Secretary) exhibited Tolles' new microscope, known as the "Tolles-Blackham" form, and requested Mr. Mayall, jun., to explain the construction.

Mr. Mayall said that the stand differed somewhat from Wale's stand that had been described by Dr. Carpenter. Wale's efforts had evidently been directed to the production of a simple and popular form of microscope. The aim of Mr. Tolles, in the construction of the stand there exhibited, was to provide highly refined means for the adjustment of the illumination, focussing, movement of the object, etc., that would enable the microscopist to obtain the most difficult results in microscopical manipulation. All who had seen the fine finish of the mechanical construction of Mr. Tolles' objectives would expect great perfection in the new stand, and he (Mr. Mayall) thought it would amply satisfy criticism on all points of workmanship. He then explained in detail the specialties of the stand.

Mr. W. G. Lettsom then described Prof. E. Abbe's binocular eye-piece, referring to a large drawing on the black-board by Mr. C. Stewart (senr. Secretary). Mr. Lettsom said the first point in Prof. Abbe's design consisted in the application of two uncemented prisms (together forming a thick plate of glass) in the *direct* tube; the adjacent diagonal surfaces of the prisms were both cut at the calculated angle of 38° 5′, which angle was computed to allow precisely one half of the light to be transmitted, and to reflect the other half; the latter half fell upon a *total* reflecting prism, whence the rays were conveyed through the diagonal tube to the left eye. The second point was the mechanism by which the *diagonal* tube, attached to the *direct* tube by a box-fitting, was moved to accommodate for the width of different observer's eyes, a screw-motion causing the tube, with eye-piece above and reflecting prism below, to travel smoothly nearer to or further from the direct and stationary tube. The third point was the application of the eye-piece to the left tube at such a distance as to compensate for the extra distance travelled by the pencil of light, and thus render the images seen by both eyes of equal magnitude. The fourth point was the application of two semicircular caps or apertures, one over either eye-piece; in one symmetrical position of these apertures the effect produced was *pseudoscopic* vision; by another arrangement of them *stereoscopic* vision was obtained. Mr. Lettsom observed that Prof. Abbe considered this form of binocular to be specially applicable to the short tubes of foreign microscopes; and that its adaptation to long tubes would be attended by some inconvenience.

Dr. Carpenter said he had recently examined the drawings of several forms of binocular devised by Mr. Wenham, and could assure the meeting that one particular form was *identical* in action with that of Prof. Abbe. [Our contributor remarks that the action of Mr. Wenham's device—as described in the *Trans. Micr. Soc.*, Vol. XIV. (1866), pp. 104-5—appears to have been arrived at experimentally, the prisms requiring to be fitted exactly to the effective angle—a difficult and complicated operation which the opticians have not hitherto zealously worked out. Prof. Abbe's plan of cutting the prisms at the precise effective angle, to transmit one half, and reflect the other half of the pencil of light, simplifies the adjustment to such an extent that any optician could make and apply the prisms.]

A vote of thanks was passed to Mr. Lettsom for his communication.

Mr. Crisp exhibited Hyde's oblique illuminator, and requested Mr. Mayall, jun., to explain its action at the black-board.

Mr. Crisp called the attention of the meeting to a new fluid for writing on glass. Mr Browning had promised to send a specimen, but had not done so. The fluid was far more active than hydrofluoric acid. If a drop were thrown on glass, and immediately wiped off, it left on the surface a tracing that presented a singular resemblance to some organic forms. He also exhibited micro-photographs of *P. Angulatum* and *Frustulia Saxonica*, by Dr. Günther, of Berlin.

Mr. Mayall desired the President to compare Dr. Günther's *Frustulia Saxonica* with the lithographs from Dr. Woodward's micro-photographs of that test-object, and with a micro-photograph by Mr. S. Wells, of Boston, produced in 1875. Dr. Woodward's showed no distinct trace of "beaded" resolution, whereas the others showed the resolution remarkably well, especially Dr. Günther's. He (Mr. Mayall) thought it would be interesting to know if Dr. Woodward would still maintain his opinion of the *unreality* of the longitudinal lines, after inspecting Dr. Günther's photograph.

Mr. Crisp mentioned that Prof. Abbe had found great advantage in mounting diatoms in monobromide of naphthaline, by which they were rendered far more visible than when mounted in Canada balsam. The refractive index of the new preparation was upwards of 1·658; therefore, according to Mr. Stephenson's views that the visibility is dependent on the *difference* of index between the object and the medium in which it is placed, diatomaceous silex would present a greater difference from the new medium than from Canada balsam; expressed numerically, the difference in favor of the visibility in the new medium would be as 22 to 11.

A communication was read from Mr. G. Shadbolt, stating that in his opinion the note in the current *Journal* of the Society (p. 875), professing to clear up the subject of immersion apertures was misleading and inaccurate, and pointing out that the addition of a few lines to a figure given by Prof. G. G. Stokes, in a paper he contributed to the Society's *Transactions* in Vol. I. (1878), would at once explain and correct the difficulty.

Mr. Crisp said he had placed himself in communication with Mr. Shadbolt, and endeavored to show that the misapprehension appeared to arise from Mr. Shadbolt's confounding "aperture" with "angle," which terms were not synonymous. To this Mr. Shadbolt had replied by repeating his objections, and regretting his absence from London would prevent his attending personally at the meeting to support his views.

Mr. Wilson was understood to say it appeared to him that Mr. Shadbolt's singular contention of the impossibility of any aperture exceeding 180° in air was refuted by Prof. Stokes in the paper referred to—that paper was, in fact, a particular refutation of the very fallacy on which Mr. Shadbolt's reasoning appeared to be based. [Prof. Stoke's demonstration of the possibility of apertures in glass greater than correspond to 180° in air was what Mr. Wilson alluded to.]

Dr. Maddox briefly described an improved form of his apparatus for collecting microscopical particles from the atmosphere.

Owing to the lateness of the hour, a note by Dr. Royston-Pigott, on his application of swinging-sub-stages in 1862-3-4, (one form of which was constructed for him by Messrs. Powell & Lealand) was briefly noticed by the Secretary, as also a note by Mr. Wenham, on a method of mounting front lenses greater than hemispheres.

A paper by Mr. C. Stewart, and sundry other communications, were postponed to the next meeting.

Four Fellows of the Society—including Prof. F. M. Balfour, F.R.S.—were duly elected by ballot, and eight nominations for election at the next meeting were announced.

The formal business of the evening closed at

9.45 by Mr. Crisp requesting the special attention of the Fellows to an exhibit by Mr. T. Powell, jun., of *A. Pellucida* (dry on cover-glass) illuminated from above by the vertical illuminator, and from below by Powell & Lealand's achromatic condenser. By the former method the surface of the object was shown resolved into "beaded" structure; by the latter method transverse lines only were shown. Both methods were used on the object at the same time, so that by screening one or the other lamp the illumination was either transmitted or reflected. The latter method was, of course, a severe test of the corrections of the objective. The new 1-12 homogeneous immersion, with which the object was viewed, proved to be of remarkably accurate construction, even by this test.

The President announced that the next scientific evening would be held on Wednesday, Dec. 1, and the next ordinary meeting on Dec. 8.—*English Mechanic.*

New Jersey State Microscopical Society.—This Society met in the College Building, New Brunswick, Nov. 22, 1880. A paper was read by Secretary Lockwood, on "Abnormal Entozoa in Man," which was illustrated under the microscope, by actual specimens of adventitious parasites. As this journal intends to publish the paper, no abstract is offered. Besides the specimens above, the Secretary exhibited a remarkable spine under about 80 magnification from the fruit of *Opuntia Rafinesquii.* (?) After some important routine work, the Society adjourned.

S. Lockwood, Secretary.

Microscopical Society of Liverpool.—The Eighth ordinary meeting of the Twelfth Session of this Society was held at the Royal Institution, on Friday evening, Nov. 5th, Dr. Hicks, F.R.M.S., President, in the chair. The Hon. Secretary announced the donation of six slides of Marine Algæ, from Mr. Grattam, of Torquay, Honorary Member.

Mr. W. A. McMurtrie and Mr. F. B. Allen, were elected ordinary members.

Rev. Wm. Banister read a communication he had received from Mr. G. E. Massee, of Scarbe, on Myxomycetozes Fungi. Mr. Massee succeeded in growing spores of Spumaria alba, and found that threads of different kinds appeared on two or three points of the surface of the spore. One kind is of a myceloid character, the other consists of oval cells multiplying by gemmation, until a torula-like chain is formed which divides, becoming nucleated, each cell increasing rapidly in size and remaining as a resting spore for nearly a year, and not taking any amœba-like form. After this some immature spumaria appears in a pulpy homogeneous mass, in which were numerous bright specks, each being a focus, round which the plasma formed naked cells of amœboid character, or Plasmodium. After three days all movement ceased, the cells assumed a spherical shape, bright nuclei appeared, and within twenty-four hours the cell wall was absorbed and the matured spiculose spores set free

The paper of the evening was read by F. T. Paul, Esq., F.R.C.S., on "The Structure, Growth and Development of Bone." The author introduced the subject with a short sketch of the comparative anatomy of the skeleton, alluding to the supporting framework of the lowest forms of life, the calcareous and horny exo-skeletons of intermediate forms, and the cartilaginous, dentinal, and osseous endoskeletons of the vertebrata. A minute description was given of the microscopical characters of bone, showing it to consist of layers of hardened fibres and bone cells in peculiar concentric circles called Haversian systems. Blood vessels occur at intervals, but the nourishing fluid was brought in intimate contact with the tissue by means of the bone cells. Bone was classed as a connective tissue, and its origin was traced from the first appearance of this tissue in the embryo, to the formation of membrane on one hand and cartilage on the other. Ossification in membrane, and ossification in cartilage were then separately described. Following this was the process of growth which varied in different bones. The paper was freely illustrated by diagrams and microscopic specimens. At the close, on the motion of Dr. Carter, a hearty vote of thanks was awarded to Mr. Paul. The meeting concluded with the usual conversazione and microscopical exhibition.

◆

EXCHANGES.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals books, magazines—anything. Describe offer fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

A good microscope, costing $136 in Paris, in exchange for a good working spectroscope. Address "Spectroscope," care American Journal Microscopy, 14 Dey Street, N. Y.

Wanted, a good neutral tint camera lucida, to fit eye-piece, 1.26 inch diameter, for 5 fine slides. Address F. N. Tillinghast, Greenport, Suffolk Co., N. Y.

Lower Silurian fossils from near the Falls of St. Anthony, Minn., for good microscopic material, etc. John Walker, 810 Ave. S., Minneapolis, Minn.

◆

HORSFORD'S ACID PHOSPATE

As an Opium Antidote, and in Epilepsy.

Mellenville, N. Y., June 28th, 1880.

I have used the Acid Phosphate in an inveterate case of Epilepsy occurring in a hysterical subject, who had been under the care of many physicians without relief. I tried all the various means of cure, with indifferent success, until I used the Acid Phosphate, with the effect of almost entirely removing the convulsions, and also of giving her natural sleep, which could only be obtained before by chloral and Bro. Potass. She also had contracted the opium habit from the enormous quantities which had been prescribed by her physicians to control the convulsions. Under the use of the Acid Phosphate she is gradually weaning off with great apparent advantage and without much suffering to herself. She has not had a convulsion in three months against one to three daily before.

Elton Palmer, M.D.

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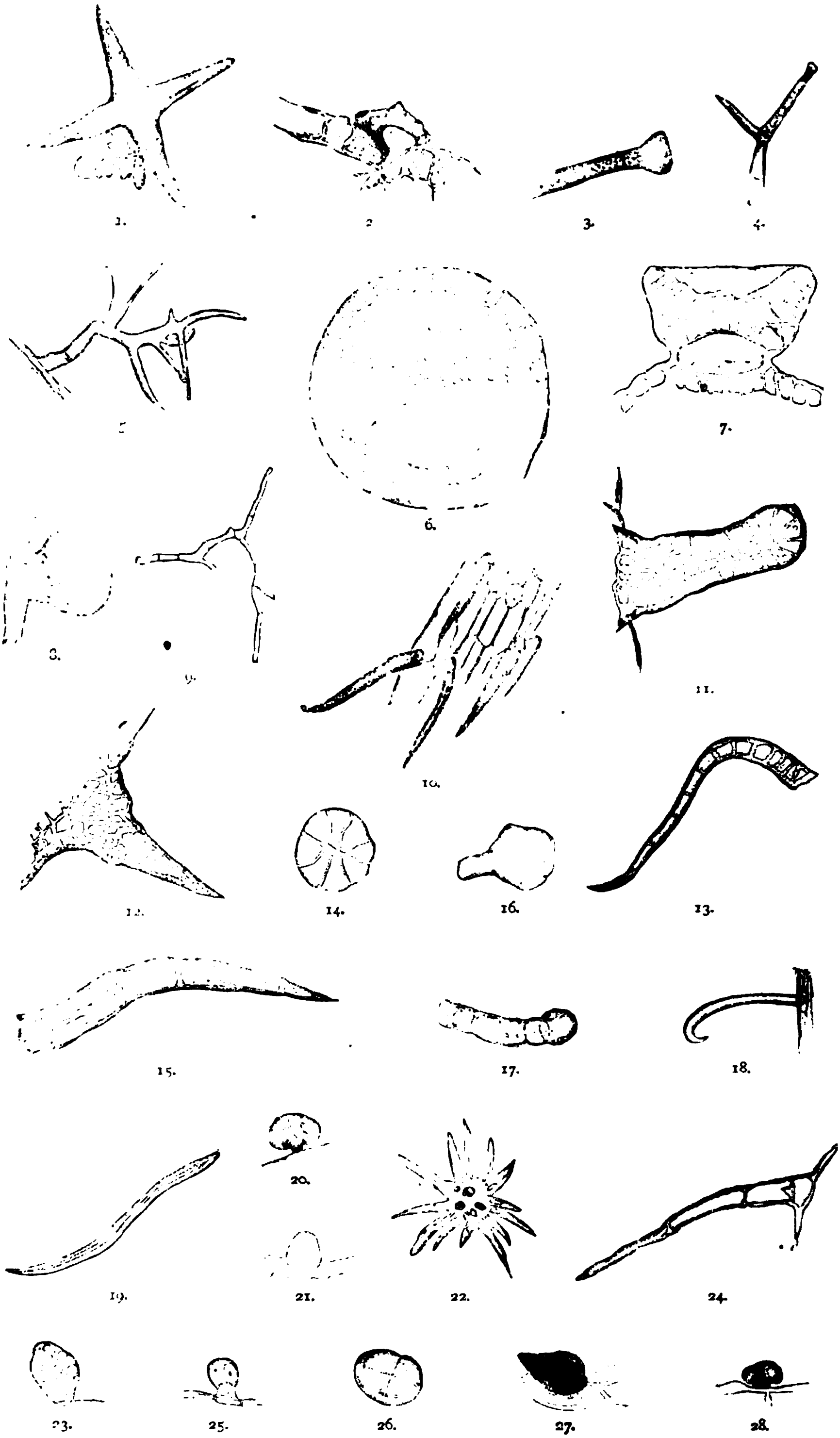

VEGETABLE HAIRS.

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Vegetable Hairs and Glands.

"By little things the growing world grows great,
And of great doings rests but little done:
From little fibres in the loom of Fate
Time's robe is spun."

Owen Meredith.

THE "little fibres" following may be as familiar to the reader as the grass he treads upon. I cannot tell. I only know that he has seen the first of the list, the *Deutzia* leaf, for it has long and deservedly been a favorite microscopic object, on account of the beauty of the stellate scales which stud its surface. These starry bodies have generally been supposed to sit lightly upon the epidermis, and to belong to it exclusively; but when an attempt is made to strip away the cuticle, or pick off with the point of a needle some of the largest and visible ones, a different arrangement is found to prevail. The rays, of which the tips only are solid, project from a body resting upon a hollow cylinder which pierces the epidermis, and has the cells of the parenchyma strongly attached to its periphery. The needle fails to displace them without considerable force, and the glass shows that the body has been broken from its silicious support. It is equally impossible to remove the epidermis and not tear away portions of the parenchyma. When the epidermis has been placed on the slide with the upper surface downward, I have in every instance found clusters of cells remaining, sure indications as to where to focus down to find a star. Fig. 1 shows a separate hair with the leaf-cells attached, the cylinder in this case, and it is by no means an isolated example, carrying lateral, projecting points, and a thickened flange-like edge that made the anchorage wonderfully firm. *Fig.* 2, is a transverse section of the under surface of the leaf, with the passage of the cylinder through the epidermis and the connection of the parenchymatous cells. Among a large number of plants whose hairs and glands have been examined, *Deutzia* is the only one thus far noticed that exhibits this intimate association of these parts with the body of the leaf; they are generally borne upon the epidermis, and easily removed without much disturbance of the parts beneath.

After *Deutzia*, perhaps not even excepting it, the most interesting in this connection is *Paulownia imperialis.* The petioles and leaves are remarkably villous, and the study of this velvety coat is eminently satisfactory. Its constituents are four forms of hairs and glands, perhaps three, as one set of the glands differs from the other apparently in length of stem only. Cellular hairs of two lengths are each terminated by a multi-cellular body forming a gland, which secretes a viscid fluid coagulable by water. When arranged in a drop for examination, globules are noticeable on their tips, and streaming out in long threads made longer by pressure, or exuding in irregular, vermicular masses. Fig. 3, is the free end of one of these long-stemmed secretory organs.

The second constituent is a hollow, branching bristle, terminating many of the long hairs in place of the secreting cells. They can be traced in transitional forms from the ordinary so-called hair with a single lateral spinous appendage as in Fig. 4, but differing in no other way, from the gland-bearing filament, up to the multifid bristle of Fig 5, where, except the one supporting cell, the whole hair has been transformed into this arborescent body.

The third forms are visible to the naked eye; they, therefore, add nothing to the velvety appearance. Sparsely scattered over both surfaces of the leaf and the upper part of the petioles, but more abundantly clustered in the intervals between the ribs where they met to enter the petiole, are cup-shaped, nearly sessile bodies, as in Fig. 6, where the superficial structure is shown, the drawing being partly in outline, and in Fig. 7, exhibiting a section of a small gland.

With *Eupatorium perfoliatum* a gland and two forms of hairs are again seen. The character of the gland is somewhat unusual. From the petiole rise two or more cells, Fig. 8, tipped by a spherical, lemon-yellow sac, filled with thick protoplasm which can be forced out in a granular mass, leaving a colorless, and, so far as I can discover, an absolutely structureless membrane. The hairs are not of special interest.

The corolla-tube of *Silene stellata* is densely woolly with ramose filaments, one of which is shown in Fig. 9, a mild specimen of their vagaries. The plant itself is abundantly clothed with multi-cellular, rough, silicious bristles.

Similar bristles, transparent and roughened by minute projections, are borne by *Echium vulgare*, Fig. 10. They resemble those of *Deutzia* in structure, not in shape, but are adherent to the epidermis only.

Fig. 11, shows a stout, compound glandular hair from the pedicel of *Penthorum sedoides*, the ditch stone-crop, a common apetalous weed. Each cell is nucleated.

The roughness of the upper part of the stem of *Daucus carota* is caused by silicious, hollow cones at the apex of cellular papillæ as in Fig. 12.

From the peduncle of *Solidago gigantea* project many hairs formed of a single row of striated cells, broad at the base and gradully tapering to the point. Shapes straight, sigmoid and variouly curved are found. Fig. 13.

Nepeta Glechoma, in addition to glands, the summit of one from the leaf being shown in Fig. 14, has many glistening bristles, varying from a mere silicious point projecting just above the epidermic level, to long multi-cellular hairs visible to the naked eye. An intermediate form is drawn in Fig. 15, from the petiole.

The curved and roughened hairs of *Datura stramonium* present nothing uncommon, but the lobose glands of the petiole, Fig. 16, standing upon a long stem, are rather unusual.

Still more uncommon are the glandular hairs of the ox-eye daisy, *Leucanthemum vulgare*, where, among long filaments, are piles of single, almost globular cells, tipped, as in Fig. 17, by a hyaline sphere.

The whole surface of *Desmodium acuminatum*, and other species, is covered by minute hooks, Fig. 18, from the petiole. On the ripe seed-pods they are especially large and plentiful, as every one knows who has become an involuntary distributor of *Desmodium* seed. They cling to the clothing with a tenacity worthy a better cause.

The skin of the peach is closely covered with sharp pointed, rigid hairs, Fig. 19, remarkable for the narrowness of the central cavity and the consequent thickness of the walls, or *vice versa*, and remarkable, too, for the pertinacity with which they adhere to and irritate sensitive cheeks.

Brunella vulgaris bears plump, sub-sessile little glands, Fig. 20, made up of two nucleated cells, which, together, form a minute hemispherical body but slightly elevated above the general surface.

Probably the simplest glandular forms are to be found on the upper surface of the veins of *Phytolacca decandra*. Each one is a single projecting conical cell as in Fig. 21. None of those examined contained either chlorophyll or colored protoplasm, and there was no cyclosis. The presence of the latter is not a frequent occurrence in the glands, but in the hairs a movement of some kind, either Brownian or a true cyclosis, is generally noticeable. This simple cell might, perhaps, be called a delicate hair with as much propriety as a gland; if it were a little more pointed the distinction would be still less. The one figured was probably as fully developed as it ever would have been, as it was taken from a large, well formed leaf on a branch in bloom. I have found them only on the veins.

The swamp rose-mallow, *Hibiscus Moscheutos* is a fertile source of supplies of the kind under consideration. The whole plant is tomentous in the extreme, with stellate hairs of many divisions radiating from an irregularly globose body, and varying in size and number of rays, in different parts of the same plant.

Fig. 22, represents a small specimen from the calyx. On the stem the rays are very long and crooked, and are mingled with remarkably lengthy filaments, which, even under a high power, appear as delicate lines. Nestled beneath the woolly coat of the calyx are the sessile glands, Fig. 23, so often met with, in this case crowded with vacuoles.

In Fig. 24, the hair of *Cerastium viscosum* is shown. It is the usual cellular filament, but with the unusual adjunct of a papilla projecting from the lower part of the first cell-wall into the cell itself. This addition is not unexceptional, neither is it uncommon. It may be only a temporary arrangement in young hairs, however, as many of the larger and more robust appear to have an aperture where in others the cone-like papilla protudes.

Leonurus Cardiaca has two glandular forms, one of which is shown in Fig. 25, and the top of the larger in Fig. 26, both with the same magnifying power. The hairs are generally short, stout, and much roughened. Most of them have only the extreme point projecting, while the body has the appearance of a rough sphere buried within the epidermis. Fig. 27, is one upon the surface. Occasionally a form is met combining the gland and the hair, a small rough cone having formed on the summit of a globular gland.

The hairs of *Vernonia Noveboracensis* are noticeable on account of the purple substance filling many of them; otherwise they are not remarkable. The glands seem to be double, and are raised on a short stem, as in Fig. 28, where the side and part of the under surface are shown.

A description of such objects, however graceful the objects themselves, is more than likely to assume the character of a dull catalogue, or a running commentary on the drawings. Every student knows that vegetable hairs are either silicious formations or collections of simple cells, and that said, it only remains to describe their shape. To avoid the dry list is difficult. Those mentioned above have been selected from the commonest plants, and none, so far as I know, have ever been figured before.

Their variety is excelled only by their abundance, and the latter is almost inexhaustible. Their description might be prolonged indefinitely. Their study is attractive, and their preparation easy. A nick with a keen knife, to raise the surface, sharp pointed forceps to strip it off, and a Mitchell's compressorium, are all the tools needed. The compressorium, in this connection, will be found a useful little piece of apparatus. Would not their study make pleasant work for those ladies who belong to the "Can't get-away Club," and who are beginning to discover the charms of the microscope? Jean Paul says, "these microscopic recreations are more lasting than all costly watering-place recreations." And much easier of access.

But *cui bono?* I once heard a public speaker say, that some people are so utilitarian that they would break the wood of the True Cross to kindle their kitchen fire, and blast the rocks of Calvary to macadamize the road to their pig-pen! Is it necessary to find an excuse for the existence of these vegetable appendages? Some years ago Utility could only guess. Of a few, at least, the use is now known. The stellate bodies within the utricles of *Utricularia*, absorb the animal infusion which bathes them; the glands of *Drosera* secrete a substance that digests the living prey they capture; and Darwin, in his book on the "Insectivorous Plants," says: "The glandular hairs of ordinary plants have generally been considered by physiologists to serve only as secreting or excreting organs, but we now know that they have the power, at least in some cases, of absorbing both a solution and the vapor of ammonia. As rain-water contains a small percentage of ammonia, and the atmosphere a minute quantity of the carbonate, this power can hardly fail to be beneficial. Nor can the benefit be quite so insignificant as it might at first be thought, for a moderately fine plant of *Primula sinensis* bears the astonishing number of two millions and a half of glandular hairs, all of which are able to absorb ammonia brought to them by the rain. It is, moreover, probable that some of the above named plants obtain animal matter from the insects which are occasionally entangled by the viscid secretion."

A. C. S.

Trenton, N. J.

EXPLANATION OF PLATE.

Fig. 1. Prickle from leaf of *Deutzia*, with cells of parenchyme attached.
Fig. 2. Same in transverse section.
Fig. 3–7. Hairs and glands of *Pawlownia imperialis*.
Fig. 8. Gland from petiole of *Eupatorium perfoliatum*.
Fig. 9. From corolla-tube of *Silene stellata*.
Fig. 10. Bristles from *Echium vulgare*.
Fig. 11. Gland from *Penthorum sedoides*.
Fig. 12. Bristle from *Daucus carota*.
Fig. 13. Hair from *Solidago gigantea*.
Fig. 14. Tip of gland from *Nepeta Glechoma*.
Fig. 15. Hair from petiole of *N. Glechoma*.
Fig. 16. Gland from petiole of *Datura stramonium*.
Fig. 17. Gland from leaf of *Leucanthemum vulgare*.
Fig. 18. Hook from *Desmodium acuminatum*.
Fig. 19. From skin of peach.
Fig. 20. Gland from *Brunella vulgaris*.
Fig. 21. Gland from *Phytolacca decandra*.
Fig. 22. Hair from calyx of *Hibiscus Moscheutos*.
Fig. 23. Gland from same.
Fig. 24. Hair from *Cereastium viscosum*.
Fig. 25. Gland from *Leonurus Cardiaca*.
Fig. 26. Tip of large gland from same.
Fig. 27. Hair from the surface of the same.
Fig. 28. Gland from *Vernonia Noveboracensis*.

Abnormal Entozoa in Man.*

BY REV. SAMUEL LOCKWOOD, PH.D.

OUTSIDE or inside, the Parasite is everywhere. Nothing that hath life is exempt from invasion by these disturbers of health, and happiness. Almost like infinitesimal germs, their eggs course through the air we breathe, swim in the water we drink, enter the ground or settle upon the plants we till, and infest the food we eat. And sometimes these unwelcome guests are insidiously introduced to us by the animals we pet, or domesticate. Indeed the lower animals have a hard time from these tormenting pests. I remember finding Mr. B. Waterhouse Hawkins in his laboratory at Central Park, dissecting a seal which had died in the Menagerie there. On opening the stomach, he let off some mild anathemas against the school children, who, he said, had killed the animal. He displayed to us about a pint of pebbles, buttons, slate pencils, and such like *indigesta*, which lay in the animal's stomach. This, to say the least about it, had a very abnormal look. But let us see! Perhaps it was the best the animal could do in the direction of a natural appetency. According to Mr. Elliott, who is authority on the Pinnipedes, the fur seals in their own habitats *all* swallow stones, and in every one's stomach, varying in size from that of a walnut, to that of one's fist, a snarl, or ball of Nematode entozoa is found. The larger seals, or sea lions, swallow stones which weigh from one to two and even three pounds each; and in one stomach, he found ten pounds of these boulders! Their use, he thinks, is "to grind up these internal pests." It may be that their movements in the stomach, sometimes dislodge the parasite when sucking at its walls, thus affording a similar temporary relief to that afforded by a good "scratching" to the victim of *Sarcoptes hominis*.

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* Read before the New Jersey State Microscopical Society, Nov. 22, 1880.

We may readily distinguish in man the adventitious from the indigenous entozoa. The latter are by scientific consent known as Helminths, and the former, although not with strict correctness, have been called Pseudelminths, since, generally they are grubs, and not worms. Moreover, among the true helminths, or entozoan annelids, we find more or less of the phenomena of parthenogenesis. Before its life circle is accomplished, it has had several animal hosts, in each of whom it maintained a distinctive form, and mode of existence. The grubs, or pseudelminths, are really larvæ of insects, whose changes are known as metamorphoses; and however great these changes may be, the beginning-form, the larva, or grub, is never wholly lost—for even in the imago state, the butterfly is really a winged caterpillar, and the true fly a grub or maggot, with wings.

Cobbold cites, but with evident distrust, the astonishing tables compiled by Rev. J. F. Hope, in which from the Helminthological records of nearly all Europe, and Great Britain, he instances not less than 40 genera of insects, whose larvæ have been entertained in the stomach of man. Strange to say, the greater number are coleoptera, whereas in America I am not able to find one good case of a beetle entozoan ; for we are not here considering epizoa, nor those parasites, which from without penetrate the skin; but those only which enter their host by the mucous or alimentary canal. I may be allowed to notice here a very remarkable case, cited by Westwood, the entomologist, and Cobbold, the helminthologist, from Dr. Pickell's account in "Transactions of the Association of Fellows, and Scientists of the King and Queen's College of Physicians in Ireland." A certain Mary Riordan, passed *per anum*, 1,206 larvæ, one pupa, and one imago of the grave-yard beetle, *Blaps mortisaga*. She had from a superstitious motive been in the habit of drinking daily water into which she had mingled clay obtained from the graves of two priests. This subject also passed large numbers of the common round worm, *Ascaris lumbricoides*, and the not so common *A. mystax*, indigenous to the stomach of the cat.

I am disposed to believe that quite often the larvæ of the diptera, or flies, occupy the human stomach unknown, the sufferer attributing his distress to some other cause.

Packard cites the Proceedings of the Academy of Natural Sciences of Philadelphia, for 1859, in which Dr. Leidy mentions the case of a physician who submitted to him a number of larvæ which had been vomited by a child. He thought they were the maggots of the blue-bottle fly, *Musca vomitoria*. Another instance was also mentioned. The sufferer in this case was a physician who detected a number of grubs in his discharges, when suffering all the symptoms of severe cholera morbus. These Leidy pronounced as larvæ of a species of Anthomyia, which it seems he had already observed in a patient who had suffered in like manner. Murray in his late hand book, avers his opinion that the cheese mite, flour mite, and milk mite, also the dysentery mite of Linnè, are all one species. This last mite gave the dysentery to Roland, a student of Linnè, who named it *Acarus dysenteriæ*. It must be noted here that the mites are in Packard's classification, degraded, or perhaps, undeveloped diptera or wingless flies. The urinals of Paris are much frequented by the larvæ of *Teichomyza fusca;* and, disgusting though it be, the maggots of this fly were evacuated by a woman, who had suffered much from their presence.

But we must come home to some facts which prompted the preparation of this paper. Last July, a young man, a teacher, brought me a number of larvæ, which he said, he had passed at stool. His appearance indicated great physical distress. His face looked haggard, his eyes dull and wild. His sight was affected, and his memory impaired. He complained of severe gripes in the bowels, like colic, and occasionally a sense of distress which he could not describe—a sort of feeling that he was going to choke, as it seemed that "the worms were crawling up his throat." The "worms," in question, he had passed the day before; and he thought that in two weeks he had discharged 200 of them. He said he thought "they kept quieter in his stomach, when he ate plenty of meat." He directed my attention to the fact that there were two kinds of "worms," one white, and smooth, and round; and the other flattish, and brown, and hairy. He further informed me that he took his dinner daily to school in a tin-pail. Hence, we see, that he dined on cold food, which was in large part cooked on the previous day. I have the specimens here, and we will look at them with the microscope. It will be seen that they are headless and footless larvæ, they are genuine fly maggots. I have given some study to them, and must pronounce the "round white ones," the grubs of the meat fly, *Sarcophaga carnaria*, whose life history is given in my paper in *American Naturalist*, vol. vii. Unlike the true blow-fly, which lays eggs, our meat-fly deposits the grubs already born. These tiny objects insinuate themselves into the creases or folds of the meat, and so for a little while are quite concealed. They take gratefully to cooked meat, and devour it with astonishing voracity. How easily could these be swallowed unperceived by a careless eater, especially if the taint of the meat had not progressed sufficiently to affect the taste and smell.

The brown, hairy, flat grubs belong to the group *Anthomyia*, or flower-flies. It is notable, however, that though the resemblance of some species of these flies to each other is very close, the maggots whence these resembling species come, are widely different. Some are round and smooth, others flat, and hairy. Hence authors divide this genus, making two, which they call *Anthomyia*, the flower-flies, and *Homalomyia* the flat-flies. They are bright, gay, diptera, seen in a hot summer day, hovering over flowers, and occasionally dipping into their nectar cups. Despite their beauty, however, they are all "bad cattle." They deposit their eggs on the esculent roots of our gardens; also on human ordure; and notably on decaying vegetables. The species before us, I take to be *A. canicularis*. A look at this grub is suggestive of great torment when it becomes an occupant of the human alimentary canal. The smooth round maggots have spiracles, or breathing holes along each side. But as our species revels in the soft animal ordure, and the juices of vegetable decay, it is furnished with a strange contrivance—starting from where each spiracle would be, is a stout hair, with sprangling bipectinations. These are branchial processes. Functionally, they are like the gills of a fish; (Walsh,) for with these they extract the air from the juices in which they wallow. It has plenty of other single hairs, which are stiff, and sharp-pointed. Thus constituted, when found where these were, we may regard them as intestinal porcupines.

But how came these unwelcome, and really abnormal guests, to gain an entrance? It was not unlike that Trojan horse business. My young friend had been eating cold cabbage. The Sarcophaga chose the meat, and the Anthomyia the cabbage; both being perhaps in that hot weather, a little over-seasoned by time.

The larvæ were brought to me dead and shrunken from being dried up. It is to be regretted that with such ample opportunity, none were furnished me alive, so that I might breed the imago. Here I would cite from a note in the *American Naturalist*, June, 1875. Says Mr. Judd: Dr. Martin of Maysville, Ky., was called to see a boy aged 14, who was seized with violent spasms. A purgative caused the lad to pass at one stool fifty maggots. This was June 5th. These were put into moist earth, and on the 17th, the perfect flies appeared. They were submitted to Baron Osten Sacken, the dipterologist, who pronounced them *Anthomyia* (Homalomyia) *scalaris*.

Among the Helminths is the section, *Nematelminths*. This is divided by Packard into two groups, the *Nematodes*, containing *Strongylus*, the round worms, and Ascaris, the pin-worms, both which are normal entozoa, to the human subject. The next group is the *Gordiacea*, which has two genera, *Gordius* the Hair snake, vulgarly called, and *Mermis*, the thread worm. These are true helminths. I have never heard of their being guests in the human subject; and yet, as adventitious entozoa, it seems to me they must occur. Their eggs appear to be so disposed of that they find their way into insects, terrestrial and aquatic.

The following incident may prove interesting and instructive.

Many years ago, I was very successful in breeding the New York Stickleback in confinement. My experiments were with the marine, two-spined variety, *Gasterosteus Noveboracensis*. I tried hard, but in vain, to breed in like manner, the fresh water species, the tiny ten-spined, *Pygosteus occidentalis*. At last I got, as I supposed, a fine female full of eggs. How I watched her day by day, and saw the abdomen steadily distending, but not the least preparation in the line of providing for an increase of family—for these little fishes are most ingenious nest builders. The affair puzzled me a good deal. At last it died. I opened the tiny thing, and found a hair worm, in a hard knot, which, when uncoiled measured nearly six inches.

Some years ago, Dr. Leidy had submitted to him a white thread worm, which he pronounced a *Mermis*, and, strange to say, it was taken out of the core of an apple, which a person was eating. In 1876, a young man sent me a white thread worm, which he had found in the core of an apple which he was eating. Having mislaid the specimen, I speak from memory, and think it was over four inches long. To my surprise, I recognized *Mermis*, and believe it to be *M. albicans*. I learn also that our fellow member, Dr. Williamson, last summer, had a case submitted to him, of two of these worms in one apple core, their length each being some three inches, for no measurement was made. These phenomena are extremely puzzling, and must be regarded as very anomalous.

I have here several inches of tape-worm. It is without doubt a *Tænia solium* as all the characteristic parts are represented. The long, so-called neck, and the head, with not less than 50 joints, or proglottides, of the so-called body. It was taken from a well, prized for its clear cold water. The man was pumping a pail of water for the horse, and observed it in the water. I have made inquiry, and cannot find any way for this to have got into the well. There is, however, a large tree, which overhangs the well, and which is often visited by birds. True, this is not the kind of Tænia indigenous to birds; but as we have shown that non-indigenous entozoa do occasionally occur, it seems to me both possible and probable, that a bird dropped it in the well.

I am aware that this subject is to most minds simply repulsive; but would not a little knowledge of these matters be very wholesome, as it might in many instances save from becoming the unwilling host of very dangerous guests.

NOTES.

With no opportunity to consult manuscript, which is with the printers, certain questions seem to require a few notes.

1. It has been asked with an air which seemed to imply impossibility: "How could a *Mermis* get into an apple?" We think it was in like manner with the Codling-moth, *Carpocapsa pomonella*. The mother moth lays an egg on the blossom end of the fruit. This hatches, and the tiny larva enters the tender fruit, while it is little more than the ovule of the flower. But later in the year these larvæ finish their changes, and themselves become parent moths. These deposit their eggs on the blossom end of the now much advanced fruit. These second brood larvæ penetrate to the core, and if caught by very cold weather, may hibernate there. Now the helminths when leaving the egg stage, have extraordinary boring power. Suppose, then, one at this stage to be accidentally deposited on a growing apple, by an infested insect. The rest, we think, might be easy. But this does imply a singular change

of habit. Yet such anomalies do occur. We find even the Codling-moth doing a strange thing. Dr. Schimer avers that on several occasions, *C. pomonella* invaded his library, even eating through the leaves of the books, to make burrows in which to pupate and spend the winter, and he cautions against storing apples near a library.

2. As to the ovo-viviparous meat-fly, *Sarcophaga carnaria*—that insects can be viviparous has been denied by no mean authority. The allegement is that the ova were hatched in the oviduct, being retained there too long, the insect failing to find a proper nidus in time. We think the following three facts oppose the allegation. (*a*) We have captured the gravid insects in long repose, and squeezed the living larvæ from them. (*b*) The frequency of finding this fly gravid with live grubs. (*c*) The fact that the Lepidoptera, both captured ones, and those bred in confinement, will, when under distraint, unduly retain their eggs, and then deposit them in very unfavorable places, but never, so far as I can learn, do they evict the living larva.

3. The allusion to the absence of parthenogenesis in the unfolding of an insect may be mistaken by the reader. Even in Biology we are sometimes met by phenomena which seem irregular and exceptional. Parthenogenesis proper, can only be looked for very deep down in the scale. We find it in the hemipterous plant-lice, the Aphides. And something of that sort has been observed even among the Hymenoptera: and recently a similar fact is claimed for a Coleoptera. Still, it may be asserted, that the phenomena cited are isolated, and in every way aberrant. They are off the normal life-line, and are as it were, certain poppings out of differentiations backward. S. L.

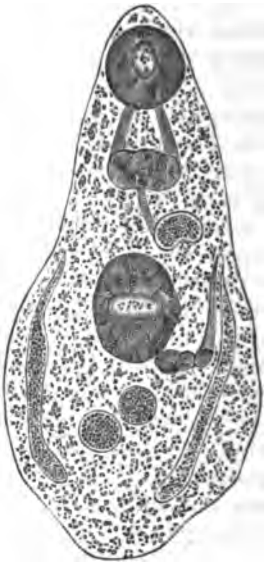
Freehold, N. J., Nov. 27, 1880.

Observations on a New Tailless Cercaria *(C. incistidata)* from the Liver of the Esculent Frog.

BY PROFESSOR EDWARD PERRONCITO, M.D., TURIN.

IN 1874 I found in the liver of a large esculent frog a white-yellowish spherical nodule, equal in size to a hemp seed. Having opened it, a little white-yellowish worm came forth, which was endowed with very brisk contracting and stretching movements.

On examining it with the microscope, it was seen to be a not fully-developed distoma (tailless Cercaria), the description and drawing of which I here subjoin. It has an approximative shape to Siebold and Bilharz's distoma Heterophies, a maximal length of 3·496 mm., and a maximal breadth of 1·596. Two suckers, one anterior, the other ventral. The transversal diameter of the superior sucker is 0·404, the longitudinal 0·352; the longitudinal diameter of the opening 0·168, the transversal one 0·152. The ventral sucker, too, has an ovular shape, with a longitudinal diameter of 0·500 mm., the transversal one of 0·448; the transversal diameter of the opening 0·260, and the longitudinal 0·188. For its inferior part and on the right side, is situated an organ, tortuous at its basis, which continues horizontally and on the same side, then rises aloof and becomes thinner and thinner, till it loses itself in proximity to the semilunar body.



CERCARIA INCISTIDATA, *Perr.*

Between the two suckers is found a yellow body of a peculiar form, probably representing a very large, strong, and muscular pharynx. It has the transversal diameter of 0·272 mm., the minimal longitudinal one 0·160, the maximal 0·184.

Laterally, on the right of, and above the ventral sucker, is perceived a semilunar body, transversely placed like a gland, formed with a membrane and some cells contained in it. This semilunar body has a total breadth of 0·216 mm., a length (starting from the tangent of the anterior point of the superior curvature to the tangent of the posterior edge of the swellings) of 0·144. The internal swelling has the transversal diameter of 0·108 the internal one of 0·080.

On both sides laterally to the ventral sucker, issues an apparently globular tube, that extends in forming a curve with its convexity outwards, in the ventral part of the animal. The left ventral lateral tube is long, 0·820 mm.: it presents nearly at the beginning a swelling measuring 0·168; after the swelling it gets a diameter of 0·096, and ends in an obtuse point. The right ventral lateral tube is long, 1·200; it is destitute of a prominent swelling, and has a maximal bigness of 0·120. These tubes consist of elements analogous to those of the above mentioned semilunar body; they have, however, a darker-yellowish color, and likely represent the beginning of the two branches of the digesting tube.

In the anterior ventral region, behind the sucker and somewhat on the left, are visible two spheroidal bodies, formed by a capsule and some cellular contents. The capsule is of a connective nature, studded with a great many little round neuclei, brightly reflecting the light, and of the diameter of 1—2 micromillimetres, i.e., 1 to 2 thousandths of a millimetre. The contents are formed by round cells with a finely-granular protoplasma, with a nucleus and some nucleola.

These two spheroidal bodies very probably represent the testicles. Of these, that which lies below and more on the left, is the larger, and has a transversal diameter of 0·208 mm., the longitudinal of 0·192; the right one, on the contrary, placed almost in the middle line, measures transversely 0·192, longitudinally 0·160.

Now, it is very difficult to detect what species of distoma this Cercaria belongs to, and I never met with any others to try experiments for the purpose. Should, perhaps, this larva have fully developed itself in some animal species feeding on frogs? It is highly probable.

Note by Dr. Cobbold.—This little trematode, of which Professor Perroncito, has already given some account in the *Annali della R. Accad. d'Agricolt. di Torino*, forcibly reminds one of the *Distoma luteum* of the common water-snail *(Paludina vivipara)*; and, but for the circumstances that Dr. Pagenstecher failed to rear sexually mature flukes in frogs fed with the pupal flukes from the snails, I should have been inclined to suspect some genetic relation. Comparing Pagenstecher's and Perroncito's figures of *Cercaria incistidata* and *Distoma luteum* respectively, the resemblance is very striking; and, moreover. the size of the sexually immature fluke from the water-snail only about one fourth of the worm from the frog. Obviously, also. Perroncito's pupal trematode, though only called a tailless Cercaria, is structurally somewhat more highly differentiated than the so-called *Distoma luteum* of the snail. It might be worth while to compare Perroncito's Cercaria with the larval *Distoma squamula*, which resides in capsules in the muscles and beneath the skin of the common frog *(Rana temporaria)*. If these forms be identical, then, I suppose, that the sexually mature worm resides in the intestine of the polecat. On this subject Zeller's paper in Siebold and Kölliker's *Zeitschrift* (Bd. xvii) should be consulted.—T. S. C.

The V Diaphragm for High Angles.

BY GEO. E. BLACKHAM, M.D., F.R.M.S.

IN response to requests for further explanations in reference to Smith's V-shaped diaphragm, let me refer to page 44 of this Journal for February, 1880, and add to the description which I have there given.

The name, V-shaped, is not very well chosen, as the diaphragm itself is not V-shaped, but only forms one side of the V, the under side of the stage forming the other.

The stage of *my* microscope has two screws on the under side, to which certain sub-stage apparatus can be attached by a sort of bayonet catch arrangement. These screws I utilize to attach my V-shaped diaphragm, which is simply a piece of ferrotype plate slipped in between the screws and held in place by the projection of their heads.

Of course, if the ferrotype plate is *flat*, it simply closes the well hole in the stage, and is thus often very useful when viewing opaque objects illuminated from above, but if one side of the plate is bent down, it leaves a wedge-shaped space between the plate and the under side of the stage, the apex of the wedge being toward the centre, and the base toward the outer edge of the stage. It is evident that if the mirror be placed on the same side as the base of this wedge-shaped space, I can, upon swinging it out to a proper obliquity, send a beam of light in upon the object, and that no light less oblique can reach the object from below. As the ferrotype plate is perfectly pliable, it can be bent to any desired angle, and thus light of any desired degree of obliquity (that the stage will admit,) can be obtained, quite free from any light of less obliquity.

With wide angled lenses this has a remarkable effect in increasing the sharpness of resolution of fine lined objects.

With dry lenses of lesser angles this arrangement can be utilized to produce very fine dark field effects, the diaphragm, in this case, being bent down *nearly* to the limit of the semi-aperture of the lens in use.

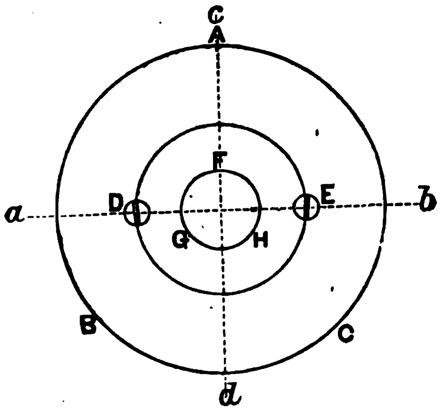


Fig. 1.

Fig. 1 shows the under side of the stage, A B C being its outer edge. D and E are screws placed on each side of the well, and not fully screwed home.

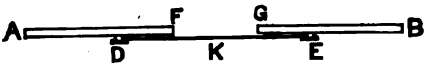


Fig. 2.

Fig. 2 is a vertical section of the stage on the line *a b* Fig. 1. K is the ferrotype plate forming the so-called V diaphragm, and the other figures correspond to the same parts in Fig. 1.

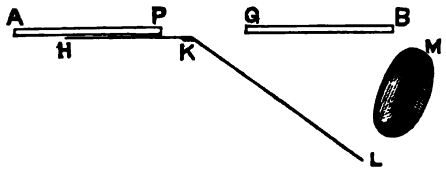


Fig. 3.

Fig 3 is a vertical section on line *c d* Fig. 1. The ferrotype plate is shown bent at K, K L forming the diaphragm. M is the mirror, which for want of room has been shown too close to the object.

The three diagrams sent herewith will, I trust, make it plain how I attach and use the V-shaped diaphragm with my stand. The mode of attachment will, of course, vary with the construction of the stage and the value of the attachment will also vary inversely as the thickness of the stage. With a reasonably thin stage, the convenience and value of the arrangement will well repay the cost of having a couple of screws set in the under side of stage. The diaphragm itself need not cost anything, any photographer will give away a piece of ferrotype plate large enough for the purpose, say three inches square, or even if disposed to do business "for revenue only," will hardly charge more than ten cents for it at most.

Dunkirk, Nov. 27, 1880.

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On the Absolute Invisibility of Molecules and Atoms.*

BY PROF. A. E. DOLBEAR.

So much attention has lately been given to the microscope, and its efficiency has so much been increased, as to have raised the hope in some persons that the ultimate molecules and atoms of bodies might yet be subject to the scrutiny of observers as such minute bodies as monads are now.

It is a pertinent inquiry, then, as to the increase in power needed, and also, the physical conditions in which molecules exist. First, as to the size of atoms. Determinations of the size of some atoms have been made by several eminent physicists. The basis here employed will be that of Maxwell, who gives five ten-millionths of a millimetre as the diameter of an atom of hydrogen. Now, under ordinary conditions, two or more atoms are combined to form a more or less compound molecule, and these are of all degrees of complexity. Thus, a molecule of water contains three atoms, a molecule of alum about one hundred atoms, and a molecule of albumen, according to Mulder, contains nine hundred. There are compound molecules known, which have nearly or quite double that number of atoms. When atoms are thus combined, it is fair to assume that they are arranged in the three dimensions of space, and, therefore, the diameter of the molecule will approximately be as the cube root of the number of atoms that compose it, so that a molecule of alum will have a diameter equal to

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* Read at the meeting of the American Association for the Advancement of Science, at Boston, August, 1880.

$$(\sqrt[3]{100} = 4{\cdot}64), \frac{4{\cdot}64}{2{,}000{,}000} = \frac{1}{431{,}000} \text{ mm.}$$

A molecule containing one thousand atoms will have a diameter equal to

$$(\sqrt[3]{1000} = 10), \frac{10}{2{,}000{,}000} = \frac{1}{200{,}000} \text{ mm.}$$

Now, a good microscope will enable a a skilled observer to identify an object as small as 1-4000 mm. Beale figures some fungi as minute as that, and Nobert's bands and some of the resolved markings upon diatoms, that have been resolved, are even finer than these. If, then, the efficiency of the microscope could be increased as much as fifty times,

$$(\frac{200{,}000}{4000} = 50),$$

it would enable an observer to see a molecule of albumen, and if its power could be increased one hundred and seven times,

$$(\frac{431{,}000}{4000} = 107).$$

one might see a molecule of alum. Some years ago, Helmholtz pointed out that interference in light waves would probably limit the visibility of very minute objects, in much the same way as the chromatic fringe limits the distinctness of larger objects, as every one is acquainted with, but, admitting that there would be no trouble from that source, there are some other physical conditions which must absolutely prevent us from ever seeing a molecule. One of these is, then, incessant motion, which is of two kinds, external and internal. A free gaseous molecule of hydrogen, at ordinary temperature and pressure, moves in a free path with a length about one ten-thousandth of a millimetre, and with a velocity in that path about 1,860,000 mm. per second, that is, more than a mile a second, while its direction is changed millions of times in a second.

Now, every one knows, who has looked through a microscope, that movement is magnified as much as the object moving. What hope can one have, then, for ever seeing a molecule of hydrogen, or any other gaseous molecule? It not only could not be seen, it could not even be glimpsed. Could any one see anything of any object whatever, even to know that it had passed in the field of view, when it moved across that field with the velocity of even one metre per second? And if not, much less when the velocity was nearly two thousand metres. But suppose that such a molecule could be caught and held in the field so that it should have no free path! It still has a vibratory motion, constituting what we call heat, which consists in a rapid change of form, and this occurs on an average *five thousand millions of millions per second.* A motion that would make the space occupied by the molecule visibly transparent. Imagine an amœba to change its form only one hundred times in a second, it is doubtful whether the thing could be even seen to be in the field. This is true of solids and liquids. Mr. D. N. Hodges, of Cambridge, has determined the path of a molecule of water, at the surface of water to be about ·0000024 mm., and though the path is still less in a solid than in a liquid, it must still be many times too great for observation.

Again, molecules are transparent. The sunlight streams through an atmosphere, yet is not perceptibly treated by it, the chief heating effects being near to the surface of the earth where watery vapor and impurities exist in greatest quantity. The stoppage of light rays in the gases is very slight indeed; so that practically the separate molecules are transparent, which would prevent one from seeing them, although their magnitudes and motions did not prevent.

There is one consideration which might exist here, viz., some molecules possess the property of changing wave lengths from a shorter to a longer one, this we call fluorescence; such a molecule in the dark field of a microscope, that is to say a field in which the only rays that were in it were too short to excite vision, might transform the short wave into a longer or visual wave, when the molecule might appear as a colored spot upon a dark background. But this would only so appear if the molecule was quiescent. If it had the motions attributed, even that could not be seen, and it is hence concluded that it must be forever impossible to see atoms or molecules.

A Simple Method of Making Rock Sections.

BY WM. C. BRITTAN.

THE process of reducing stone and other hard substances to thin sections for microscopical examination by the methods usually employed by amateurs is one both tedious and laborious, requiring a great amount of patience and some ingenuity, with a commonly unsatisfactory result. Believing that I may possibly help some who have been deterred from this kind of work on account of its difficulties, I offer a few suggestions from my own experience in this direction. I think the method I shall describe, to be something new, and, also, one that will be found very efficacious with all substances not too hard to be reduced by grinding with emery.

The first thing required, is a slab of plate-glass—3 x 4 in. is a very convenient size. This should be set in a block of wood—a circular piece of inch thick pine with three screw heads placed triangularly underneath, will be found to give it great solidity upon the table, a qualification very desirable in doing delicate work. Now, upon this piece of plate glass, with emery and water, grind one side of a glass slip until it presents an evenly ground surface. You now have the ground glass described by me in the number of this Journal for June, 1880. Next, take the stone or other substance from which you wish to make a section, and in the same way grind down one side of it until you have a face that suits you. Place a drop of balsam on the ground surface of the slide, pass it over the flame of the lamp until sufficiently hard to *chip* when cold, while still hot, place your stone in position, press down as close as possible, being careful not to enclose air bubbles underneath. It is also important that the object be perfectly dry, as any moisture would cause air bubbles when placed in the hot balsam. This part of the process should be carefully done, for the object is now in its final resting place, and is not again to be disturbed. When the slide is cold, with alcohol, or ether, clean away all the surplus balsam, return to the glass slab, and grind down the other side of the section, just as thin as you like, using the finest grade of emery in finishing. In this way, sections of almost any size and uniform thickness, can be made perfectly free from breaks and flaws.

After the slide has been thoroughly washed and dried, it is ready for the cover glass. For this purpose, I first place a drop of turpentine upon the object, allowing it to spread entirely over it *without excess*, this expels the air and prepares it to receive the balsam. Next put a drop of balsam on the cover-glass, and harden over the flame as before, only not quite so hard this time; let it cool a little, turn it over and place the drop, which hangs suspended, upon the centre of the object, heat the slide again very slowly over the flame until the cover gradually settles to its place, then gently press it home. When cold, clean away all the surplus from around the cover, wash thoroughly with soap and water, and the slide is finished, making a handsomer mounting than is possible by any other method known to me. This process cannot be followed with any other than the ground glass slip. If the ordinary slip be used, the object must be transferred from the glass upon which it is ground to the slide upon which it is mounted, which, in very delicate sections, is most difficult to do without breaking. I should like to hear from those who give it a trial.

Detroit, Mich., Dec. 2nd. 1880.

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AND

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Our Sixth Year, 1881.

IN accordance with a time-honored custom, on commencing a new volume, we place before our readers the present condition and future prospects of the AMERICAN JOURNAL OF MICROSCOPY.

As regards its present condition, so far as the number of subscribers and the kindly feeling which exist towards it, the year 1880 was altogether the most successful year in the history of the enterprise. We obtained more new subscribers than in any former year, except the first, and large numbers of those who had ceased taking it after the second year, (when the price was raised), have again entered their names on our books. And already the subscriptions for 1881, are coming in with a rapidity that we have never known before. Even at this early day our list is large enough to ensure success for the coming year.

The prospects of the JOURNAL for 1881 are more encouraging than they have ever been before. We have abundant promises of valuable articles from men whom we know to be reliable, and of aid from those whose ability has been tried, and not found wanting. Several of our subscribers have promised to send in large clubs, and some have actually done so. One gentleman sends us four, and kindly intimates that it would be very easy work for each present subscriber to "go and do likewise."

We can assure our friends who wish to make the effort that their labors will be fully appreciated, and we will endeavor to render a *quid pro quo* in a larger and more handsomely illustrated journal.

Of promises, we have always been chary. We feel sure that every volume that we have sent out has been quite as good as anything that we promised, and frequently much better. We do not now propose to break through our old rule, except to say that with the larger experience, more extended facilities, greater support financially, and wider circulation, which 1881 has actually brought to us, we ought to be able to make the sixth volume better than any of its predecessors.

And now, before we close, one word as to lost and duplicate numbers. The JOURNAL is now electrotyped, so that we can at any time reproduce any given number at comparatively small cost.

The greatest care is exercised in mailing the several numbers, and yet, with all our care, we find that occasionally a number fails to reach its destination. The rule amongst publishers generally, is that all numbers are sent at the risk of the subscriber, but this rule we have never adopted, and, whenever a number has been lost, we have cheerfully replaced it free of cost, when notified of the fact. In many cases the number first sent has turned up afterwards, and some of our subscribers have been so conscientious, as to return their duplicate numbers to us. We would much rather, however, that they would hand them to some friend that is interested. And now, with the kindliest feelings towards all with whom the JOURNAL has brought us into contact, whether they take the voyage for 1881 with us or not, we enter upon what we hope will truly prove

A HAPPY NEW YEAR.

The Inventor of the Binocular Microscope.

IT has always been a difficult thing to award to each inventor his just share of the credit due for bringing to perfection any of the great inventions which have proved landmarks in the world's progress. Neither the steam engine, the telegraph, or the printing press are due to the efforts of one man, and the same is probably true of the invention of the binocular microscope. Over two hundred years ago attempts were made to construct a binocular microscope, but it was only as late as 1853–4, that a really serviceable one was produced. In the latter year, Prof. Riddell, of New Orleans, who had previously experimented considerably with prisms made by the late Mr. Fitz, so well known as a maker of telescopes, obtained from J. & W. Grunow, of New Haven, Conn., a binocular microscope made by them after his plans. This was, undoubtedly, the first of the modern binocular microscopes and the priority of Prof. Riddell has been very generally acknowledged both in this country and Europe, by those who were familiar with the facts. But owing to the circumstance that Prof. Riddell's binocular did not come into general use it was lost sight of. No mention of it is to be found in the large and elaborate catalogue of J. & W. Grunow, which they issued in 1857, and which was rather a treatise on the microscope than a catalogue. In the "Microscopist's Companion," by Prof. John King, of Cincinnati, published in 1859, the binocular microscope is barely mentioned. At page 47, we are told that J. & W. Grunow manufacture the binocular microscope of Prof. Riddell, at prices ranging from $100 to $150, and at page 210, (in the Glossary) we find the following:

Binocular Microscope, a microscope with one objective and two compound bodies and eye-pieces, for using both eyes at a time; it is said to have a beautiful stereoscopic effect, giving solid forms to the objects examined. Messrs. Grunow, of New Haven, manufacture these microscopes, which cannot be used, however, with objectives higher than ¼ inch or ⅛ inch.

But Prof. Riddell's invention was lost sight of, and, except Prof. King's work, we believe that our own little book is the only treatise published in this country which gives Riddell the credit to which he is entitled. Wythe and others do not so much as mention his name. It was, therefore, refreshing to see in the *English Mechanic* last summer, a letter from an Englishman who gives full and generous credit to Prof. Riddell as being the first to devise a useful binocular microscope. This writer also calls upon Americans to write up and publish the history of the invention before those who were familiar with its early history shall have passed away.

This Englishman was F. H. Wenham, and it is greatly to be regretted that Col. Dr. Woodward, who has recently published an article giving the history of Riddell's binocular, should have omitted to note this fact. It was doubtless a mere oversight, but as Col. Dr. Woodward gives great credit to Mr. Holmes, for his generosity in acknowledging in the *English Mechanic* Prof. Riddell's claims, it would have been but proper to have included Mr. Wenham.

And as Mr. Wenham has freely and fully acknowledged the claims of Riddell, let not his own claims in the matter be ignored. However much Wenham may owe to Riddell, it is an indisputable fact that it was Wenham's modification which gave the binocular microscope, its capability of coming into general use. This is shown by the fact that the binocular on Wenham's plan is in common use in England and America, while on the continent of Europe where this modification has not been introduced, the binocular is looked upon with disfavor. And of all the makers of binoculars in this country, every one uses the Wenham prism.

We, therefore, feel that Americans should not only accord full honor to Mr. Wenham for his special invention, but give him the credit of having freely accorded proper honor to our own countryman.

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Trichinæ in Chickens—A Correction.

IN our report of the Figge trial for damages for selling trichinous meat, we stated, on the authority of the report published in the Brooklyn papers, that Mr. Atwood had said that he had found trichinæ in chickens. Mr. Atwood writes to us, to say that the reporter made a mistake, and that no such statement was made by him.

We noted at the time the fact that Mr. Atwood's experience, if correctly reported, was at variance with that of most other observers. Cobbold and others have fed trichinous flesh to poultry, and afterwards examined the flesh for trichinæ, but in no case were any found. This is a singular circumstance, for which we believe no satisfactory reason has thus far been adduced. At first sight, one might suppose that the peculiar mode of digestion, which obtains in the case of birds, might be the cause, but this is evidently not the true explanation, since living trichinæ are found abundantly in the lower part of the digestive tract after the fowl has been fed with trichinous flesh. Thus far, however, we believe that no trichinæ have ever been found encysted in the flesh of the ordinary breeds of poultry.

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Caution to Users of Soap.

A CORRESPONDENT who has tried the method of cleaning diatoms recently described in this journal by Prof. H. L. Smith, says that these directions alone are well worth the cost of a year's subscription to the JOURNAL. At the same time he gives a caution which well deserves the attention of those who use soap. It is a well known fact that many of the brands of soap in market contain notable quantities of silica, in various forms. Even the fine toilet soaps contain it, the addition having been made for the purpose of increasing their detersive power, while to many of the more common kinds, kaolin, silica, etc., are added merely for the purpose of cheaply increasing the weight of the article. Therefore, in using soap, see that you do not use a specimen which will introduce insoluble matter, and even diatoms foreign to the original gathering.

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Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

A New Test-Plate.

Ed. Am. Jour. Microscopy—I have recently had the pleasure of examining a new test-plate of diatoms, prepared by Mr. H. C. Maine, of Rochester, N. Y. This plate is made upon the principle of the celebrated Muller "Probe Platte," but is in several respects its superior. The diatoms are thoroughly cleaned and beautifully mounted in balsam.

Unlike the German "platte," the diatoms in Mr. Maine's American "Test-plate" are all perfect. It is well known that in Mr. Muller's "Platte" the arrangement of diatoms is not good. Some marked as quite difficult of resolution, are resolved more easily than others arranged lower in the scale. This is remedied in the new plate of Mr. Maine. The diatoms are nearly—but not entirely—the same as Muller's. The first three and last two diatoms are Heliopelta. Between these the new plate has twenty-three tests, instead of twenty, as upon the old plate. The last four are Amphipleura Pellucida—all perfect—from different localities, and varying materially in difficulty of resolution. The last and most difficult test on the new plate is A. Pellucida, found in Lake Ontario. This new plate I understand has been submitted to some of the best diatom workers in the country, and by them pronounced equal, if not superior, to anything yet made. DANL. G. FORT.

Oswego, January, 1881.

Graphiology—Blood-Stains.

Ed. Am. Jour. Microscopy—Allow me to thank you for your frank notice of Prof. Wythe's book on the microscope. It is too often the fact, that book notices are so unreliable that instead of being, as they should be, trustworthy guides to purchasers, they, on the contrary, serve to mislead. This condition of things becomes a serious evil, especially as it regards high priced books, as in most cases it is impossible to get a knowledge of their value before purchasing them, and thus one is betrayed into spending money for what is too often nearly or quite useless. Had you criticised the article on handwriting, from the same source, published in this number of your journal, you would, I think, have come to a similar conclusion as to its value as authority, as in the case of the larger treatise. The proposition in this remarkable paper amounts to this, that it is possible to distinguish hand-writing, through the difference in the "wavy margin to the letters, when well illuminated on the stage of the compound microscope." Now this wavy margin is varied by many causes, such as rapid or slow movements of the pen, thick or thin ink, paper more or less absorbent, aside from nervous excitement, alcoholism, etc. I send a few samples in illustration. These are taken from the writing of three different persons. They are magnified some forty diameters and are carefully outlined by means of the camera lucida. No. 1 B, is from the handwriting of a person eighteen years of age. A 1, 2, 3, from that of a person thirty years of age, and P 1 2 from one of sixty. A 3, is from a rapidly made ink stroke, while all the others are from letters made at the ordinary rate of the writers. The ink and paper in each case was the same. It would require sharp eyes to distinguish the hand-writing of either of these parties by the "rhythmical" edge of the letters, while by other and proper methods of comparison there would be no difficulty. "In cases of writer's cramp," we are told, "this rhythm is greatly exaggerated or interrupted." Further, "paralysis of the ulnar nerve, rheumatism of the shoulder or wrist, neuralgia and alcoholism may also interfere with the rhythm of progress." "But in no case is the failure of the rhythm so marked as in a voluntary attempt at imitation." That is to say, if this means anything, that in a voluntary attempt at imitation this rhythm will be more than "greatly exaggerated or interrupted," or that if one should attempt to imitate the handwriting of another the edge of the ink stroke would be more irregular than it would be, if he should chance to become subject to writer's cramp, paralysis of the ulnar nerve, rheumatism, or alcoholism (one at a time, we will suppose,) and endeavor to write, it is presumed, without such attempt at imitation. Further back we are told that, "In age or infirmity, these impulses are perceptible to the eye, while in the other case, it requires the compound microscope to see them. Still further on, to repeat, they are more marked in voluntary attempts at imitation. How to reconcile this jargon of comparisons would more than puzzle a Philadelphia lawyer.

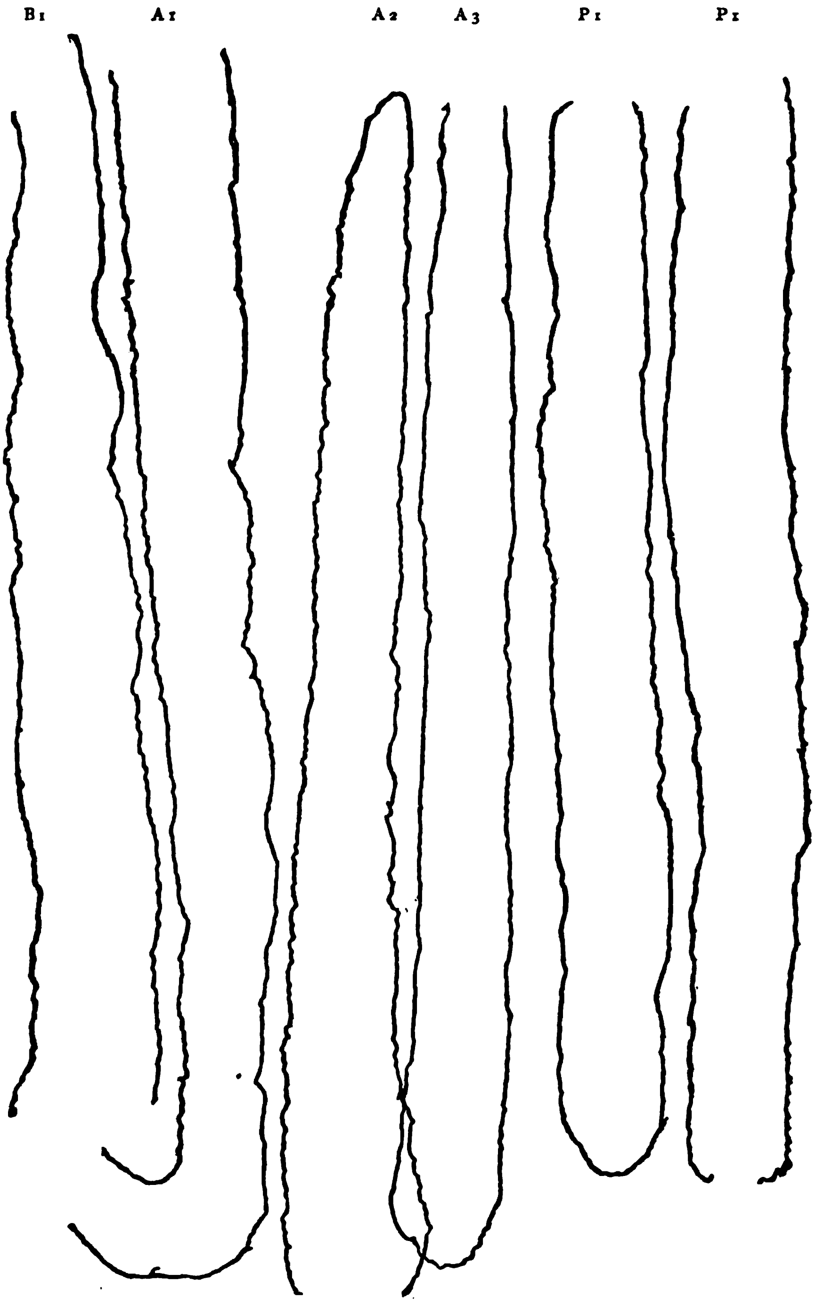
The truth of the matter in this respect is, however, that upon examination of the writing of the expert forger under the microscope, we generally find the sides of the ink strokes much more even (less tremulous) than those of the one they are intended to imitate. Indeed, this is often one of the very means by which the fraud is detected. In a recent case in which I was employed, this sharpness and regularity of the ink stroke, as seen under the microscope, was so remarkably in contrast with the roughness and irregularity of the original writing, that this fact alone was regarded as almost conclusive evidence in the case.

In a recent criminal trial, a certain professor testified that in all cases of the forgery of signatures "conscience interfered in a greater or less degree, and that he could tell, therefore, in most cases the fraudulent from the genuine."

The counsel asked him if he meant to say that where conscience interfered to a certain degree he could tell, but where it interfered to a less degree he could not tell.

He replied that this was precisely his meaning.

Further, he was asked, how he discovered this law as to the operation of conscience in connection with written signatures, inasmuch as he was only able to demonstrate it in its higher workings? In other words, was it not founded



PEN-STROKES MAGNIFIED FORTY DIAMETERS.

on mere inference up to a certain degree, and where, then, did it come in as law, or how did he determine this point?

And so the questioning went on, and thus is so-called expert testimony held in disrepute in the courts, where the generally expressed opinion as to its value is based upon such exhibitions as these.

In conclusion, allow me to say that it is most astonishing with what perverseness or ignorance certain persons belonging to the medical as well as the legal profession persist in misrepresenting the claims of those who have been engaged in the investigation of blood stains. In the *Central Law Journal*, vol. 10, p. 189, it is stated that Dr. Treadwell, of Boston, "was of opinion that he could distinguish human blood from the size and form of the corpuscles." Dr. Treadwell says, in substance, in a recent published paper of his, that he "has always been careful to state that human blood has nothing in itself by which it can be identified." Next comes Dr. Lemmon, in your journal for September, 1880, and makes a similar unwarranted statement in regard to myself and others.

On page 597 of the *American Law Register*, for September, 1880 I say: "It must be kept constantly in view that the real question is not whether human blood or that of any other animal can be identified as such," etc. On p. 603 of the October number of the same journal, I say in regard to a similar statement, "neither Dr. Treadwell, nor any other expert, as I believe, ever in any case claimed to be able to *identify* human blood or the blood of any animal whatever." That the non-professional community should fall into such errors is not strange, but that scientific gentlemen of either profession, should do so, indicates a strange perversity.

R. U. PIPER.

Chicago, Nov., 19, 1880.

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Synopsis of the Belgian Diatoms.

Ed. Am. Jour. Microscopy.—Permit me to second the commendation by my friend, Prof. Smith, of Dr. Van Heurck's Synopsis of the Belgian Diatoms. Fasicle 2d has just been received, containing 20 plates, representing the genera Navicula, Schizonema, Van Heurckia, Donkina, Scolopleuria, Toxonidia, Amphipleura, Pleurosigma, Amphiprora, Gomphonema, Roicophenia, Achnanthes, Orthoneis, Campyloneis, and Cocconeis in part, with over 600 figures. Both fasicles contain 883 figures. Certainly, since Pritchard's Infusoria and Wm. Smith's Synopsis are both out of print, and consequently copies are rarely to be obtained, and then only at a great price, there is no work on the diatoms, accessible to new students, that covers so much ground, to be obtained at a moderate price. Prof. Cleve's "Arctic Diatoms" is a fine and very desirable work, but comparatively limited. Dr. Schmidt's Atlas is a magnificent work on a magnificent scale, but it costs a magnificent price. So, like Ehrenberg's Microgeology, its ownership will be limited to those with full purses, and public institutions.

Prof. Smith says the plates are not quite equal in artistic merit to those of Wm. Smith; true, but they probably represent even better the actual appearance in the microscope, while several of the plates in fasicle II are excellent. I will specify the plates of Van Heurckia, Toxonidea, Orthoneis, and Cocconeis. Some of these figures give better ideas of the peculiar specific characters than any others that I am acquainted with.

There are, in some of the genera, many figures of varieties, with the synonyms of different authors. There are 147 figures of Gomphonema. Perhaps by their aid, my friend, Mr. Vorce, can clear up his perplexities about species. At any rate, if these figures do not help him, I fear that his case is hopeless.

Subscribers for Schmidt's Atlas have been for months anxious about the continuation of that work, none having been received for a year or more. I take this occasion to say that I have been lately advised that Dr. Schmidt has been for some time too ill to attend to the publication. That by the last reports he was recovering, and the publication is expected to be resumed immediately.

C. S.

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A Grey-Beard's Experience.

Ed. Am. Jour. Microscopy.—"When doctors disagree, who shall decide?"

I am an old man, living in the swamps of Louisiana, and although I have not got much education, still I "take the papers"—all sorts of them, not slighting the AMERICAN JOURNAL OF MICROSCOPY—and read them too.

Years ago, when I commenced to use specs, they improved my sight so much that it created a desire for a microscope. About that time the papers were teeming with advertisements of wonderful microscopes, from four bits to two dollars and fifty cents each. Thinks I, *humbug*, but seeing the same in a religious paper (now religion don't lie, and, consequently, a religious paper is supposed to tell the truth), and endorsed by the editor, I invested my *two fifty*, and got a few pieces of *brass* and round glass which made something look *big*, but what the big thing was, I don't know to this day. Next I wrote to an optician (?) who promised a wonderful instrument for $10. Invested the $10, and saw some things in pretty good shape, but they seemed to have been painted with a rainbow. Complained to Mr. Optician, who gave me a dissertation on *chromatics*, and stated that I ought to have an achromatic glass—would send me a fine one for $25, taking the $10 one in part pay. Off went the money, and I got something somewhat like a microscope—about as good as the $5 ones of the present day. Not pleased yet, Mr. Shoptician said a man of "my ability" needed a *first-class* glass, and he would send me a *very fine* second hand one, and, as usual, take the last in part pay. Now I had been *bit* three times, so wrote him to let me look at it, and if I did not purchase, would returned it free of cost. It is needless to say that I paid the transportation on this glass both ways.

By going back to A. D. 1640, I find I have a little English blood in me, and supposed it must have been the principle that "blood will tell," which decided me to import a microscope from England. After a while it came, looked fine and cost enough to be good, (I now know it is good)—a regular double barreled fellow, with more "fixins" to it than I know what to do with. Bought some books, and tried to follow instructions. One says, with light, objectives, and eye-pieces, so and so, you will find the markings on a certain diatom, to be raised dots. Well, I saw them round, six-sided, and like the whole gable end of a house, the pointed gables overlapping like a shingled roof. Have seen (known) round dots look six-sided, and (known) six-sided dots look round. Some one intimated that my objectives were faulty. One said, get low angled ones, and another, very high ones. I split the difference by getting both, expecting to penetrate into the bowels of the earth with one, and to see half round the world and a little of the other side thrown in for "lagniappe" with the other, but I have accomplished neither one nor the other. Ah! what is a poor old man to do under so many scientific difficulties?

A good editor is an educator, consequently, Mr. Editor of AMERICAN JOURNAL OF MICROSCOPY, you are a schoolmaster, with a very large number of pupils, old and young, bright and dull, advanced and beginners, yet they are all pupils of your academy, viz., AMERICAN JOURNAL OF MICROSCOPY. A pupil who desires to learn likes to ask questions, and have his teacher talk. It is better for a pupil to have *one* good teacher in a special branch, rather than a dozen able ones whose views differ on many points.

Now the object of this long yarn is to suggest that, in addition to your free page for questions and answers, you talk yourself of the many *little things* in microscopy, especially as to manipulation for beginners, such as most writers think too insignificant to speak about, thus instructing your pupils, so that "when doctors disagree" they may become able to decide for themselves. A few years experience with a common instrument has taught me that the trouble with beginners in microscopical manipulations is the *little* things rather than the great. 'Tis said, "great minds run in the same channel,"—evolve the same ideas, but I think microscopy in its writers deny it. Before me are books and papers by Hogg, Carpenter, Frey, Wythe, etc., etc., not "ad infinitum," but ad much money out of my pocket, and if any one can make their views in many respects homogeneous (stop a minute, let me ask a question: In what does the *homogeneousness* of a homogeneous lens consist?) he will be possessed of more resolving power than any objective I have.

As there is a sort of bond of sympathy between those who use optical instruments, let me tell of one of my losses. I had a ten foot reflecting telescope made about forty-five years ago by a self-made optician. It was taken to Philadelphia to compare with one at the Franklin Institute, that—if my memory serves me right—was considered one of the best in the United States, at that time, and was pronounced equal to, if not better than that instrument. I prized it, and kept the eye-pieces with me, but left all other parts at a former residence on the seaside, during the little unpleasant difficulty between the North and South, fifteen or eighteen years ago. After peace, my telescope was not to be found. Some years after, in Mississippi, I was called upon to assay some ore, it being reported that a silver mine had been found. I assayed the supposed silver ore, and found it fine speculum metal, and further investigation revealed the fact that it was the reflector of my fine telescope, which a negro had stolen during the war, and kept secreted in his cabin, hundreds of miles distant, supposing it silver, and had not his cabin burnt down, thereby developing this silver mine! I likely should be ignorant of the fate of my telescope to this day. Ah me! had I the cash in hand that it costs, I'd take a trip North and spend every cent of it in its twin sister—a fine modern microscope.

A postscript before I sign, and then I am done. I see in the September number of the JOURNAL OF MICROSCOPY, that a certain M. D. strongly intimates that Dr. Joseph G. Richardson is ready to back his opinion with an oath as to the identity of a blood stain with human blood. I am not an M.D., but if the M.D. will read Dr. Richardson's writings *as carefully as I have*, he must come to a different conclusion.

GREY-BEARD.

In the Swamps.

Blood Stains in Medical Jurisprudence.

Ed. Am. Jour. Microscopy.—The October number of your journal lies before me. In it appears two letters in response to one written by myself, in the number preceding, on the "Diagnosis of Blood Stain in Medical Jurisprudence." I have in reply to say, (after first thanking Dr. Richardson for his courteous and dignified response), that I offer him my sincere apologies for the misconstruction, which, though it argues me beyond the pale of those earnest workers in microscopical sciences, among whom Dr. Richardson shines *facile princeps*, I, nevertheless, admit. To this brilliant savant and measuring-man, who, not content with measureing infinitesimal distances with his microscope, measures also the mental acuteness of the *profanum vulgus* by a hasty misconstruction of a paper which, I have just noticed, has been pronounced by as high an authority as Dr. Woodward to be liable to misconstruction to others than skilled and experienced workers in this special line of research, I make the following proposition: You say that you are able to identify human blood from that of animals, whose corpuscles measure on the average 1-4000 inch and less. Are you willing to test this after some such fashion as that mentioned in my first letter? I will prepare, or have prepared, blood specimens from man and several animals, the average diameter of whose corpuscles measures, according to Gulliver, (whose accuracy you commend) 1-4000 inch and less. It is fair, however, to state in this connection, that I shall cause one or more of the specimens to be washed and dried after a manner that I have noticed materially affects their diameter, at least apparently, to one beyond the sacred precinct of the earnest workers referred to above.

To avoid future discussion, I will withdraw also what I stated of Dr. Piper, whose name and platform on this subject, together with that of Dr. Richardson, I became acquainted through the medium of the public press, a most unreliable source, and one which I again apologize for using. As regards President H. C. Hyde, of San Francisco, I make the following quotation, premising that in the blood of the dog we have an approximation to that of man, amounting in many cases, to identity. [See Dr. Woodward in *American Journal of the Medical Sciences*, for January 1875, p. 158-9.]

Thus President Hyde, in AMERICAN JOURNAL OF MICROSCOPY for January, 1879, p. 11: "But the elaborate researches of Carl Schmidt to determine the relative size of the blood corpuscles in different species of animals, have now given data so frequently verified, that the examination of blood stains by the microscope has become one of the most reliable methods yet suggested for the discovery of crime in cases where the presence of the blood of the victim is an important item of evidence. *They have ascertained and established the fact, abundantly verified by other observers, that the blood corpuscles of man, the ox, sheep, dog, pig, rabbit, and several other animals may be absolutely distinguished from each other through differences in average size, and while these differences may be minute, they are constant in each species, and so marked under the use of high powers, that it is hardly possible for a skilled observer to mistake one for another.*" (Italics mine).

Now, my own observations lead me to question the accuracy of the above most doubtfully, and I have finally to say to Mr. Hyde, and all who hold with him, that I should be most glad to subject the above statement to a crucial test and have the matter finally settled.

RICHARD H. LEMMON, M.D.

Charlotteville, Va., Nov. 20, 1880.

[As regards changes produced in the size of the corpuscle by special methods known only to scientific men, we should not consider such a test fair. The specimen of blood should be presented to the microscopist in a condition as nearly like that in which it would occur in practice as possible. We doubt if a jury would attach any weight to evidence derived from stains which had been washed with strong chemical agents.—ED. A. J. M.]

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Academy of Natural Sciences, Philadelphia—Biological and Microscopical Section.—At the meeting, November 1, 1880, Dr. Carl Seiler in the chair, Dr. J. Gibbons Hunt, in referring to a communication made some time ago, said the announcement then made by him that ciliated epithelia covered the intestines of vertebrated animals, was received with considerable doubt by some of the members of the section. Since then a German journal contained a similar statement, which also fully verified his observations.

Dr. Hunt presented for examination some hairs taken from the head of an aged lady which were of a beautiful carmine color. They were short hairs growing underneath the gray and covered the entire head. They presented no pathological condition. The color is permanent and of a uniform carmine tint. Under the microscope there was no other abnormal appearance.

Dr. Hunt, chairman of the committee appointed to prepare a report upon the exhibits and improvements in microscopical science at the fifteenth annual exhibition of the section, held October 15, 1880, read the following paper:

The committee appointed at the last meeting of the section to report matters of interest brought forward at the fifteenth annual meeting of the "Microscopical and Biological Section" of the Academy of Natural Sciences, beg leave to offer the following report:

The hall of the Academy was comfortably filled with, perhaps, 2,000 visitors, who were distributed all over the building, the museum being opened and lighted for the fuller entertainment of our guests. The entomological section contributed to our success by generously displaying a portion of their magnificent collection of butterflies, moths, and beetles; insects of most gorgeous color, and forms so curious and rare that they will be remembered by many for a long time to come.

Without seeking ungenerously to depreciate other scientific organisations by unduly exalting the Academy, we say that no other scientific society in our city ever had within its walls such an assembly of interested and intelligent citizens as was in the Academy on that occasion.

On firm tables arranged for the purpose one hundred and twenty-seven microscopes were in position, displaying objects ranging through many classes of the mineral, vegetable, and animal kingdoms, and illuminated in nearly all approved ways. Of this number of microscopes, Zentmayer made 48, Beck 30, Crouch 23 Bausch & Lomb 7, Queen & Co. 5, Hartnack 2, Sidle & Poalk 2, Gundlach 1, Ross 1, J. C. Green 1; J. H. Steward 1, unknown 6.

Your committee can look back to the beginning of microscopy in Philadelphia, and at that time, and for a long period after, Nachet's microscopes were the only ones—with few exceptions—then in use. Now those inferior French instruments are not reported at our meetings.

It would be neither profitable nor interesting to report all the commoner objects shown at the meeting, not because such exhibits have not equal educational value with rarer things, but for the reason that they have been mentioned on previous occasions and in the reports of similar meetings elsewhere. We will ask attention, therefore, to such objects only as best mark the progress of microscopy at this time.

Many preparations of animal tissues, human and comparative, were shown, such as injected lung, kidney, brain, skin, etc., and some were stained with carmine, then bathed in acid and mounted in balsam, *secundum artem obsoletum;* and all such looked about as well as could be expected.

Best experience, however, is becoming convinced that it is no longer good work to stain *only* the bioplasts, and to fill the vessels with gelatine colored with carmine, and mounted in balsam. Around every bioplast so treated is the cell-body, larger or smaller, which remains invisible. Moreover, growing and finest vessels cannot be structurally demonstrated in that way, neither can the connecting tissues which bind all other parts together be demonstrated or studied by these old processes.

Such work has no longer any significance in the entire and correct interpretation of the tissues, but it does create abnormal stomata, and apocryphal perivascular spaces to be found only in the books. These relics of a *past* era in microscopy should now be placed carefully away in the back drawers of histological cabinets, thence to be dug out like strange fossils by coming generations of microscopists.

The time has come to move forward by doing better work in which more tissue elements shall be demonstrated. Some recent sections, double stained, by Cole & Son, of London, were shown at the meeting, and they revealed more tissue elements than any other balsam mounts yet seen this side of the Atlantic.

The division of cartilage cells during change towards bone—the so-called osteoblasts—medullary cells and fat cells, all with bioplasts showing division and vacuolation; not nebulously and doubtfully, but sharply differentiated under 500 ×, with the binocular, could be seen, educating us more fully into a better understanding of such things. We welcome such advanced work regardless whence it comes. A beautiful slide of the young bot fly (*Œstrus gasterophilus*) attached to a hair from the horse, is worthy of report.

Living polyps (*Pectenatella magnifica*), and the new rotifer (*Apœcia emiliæ*) intermediate between Lascinularia and Melicerta, are reported, as well chosen illustrations of uncommon pond life.

In exhibits of plant tissues, by double staining, we saw nothing new. Indeed, truth compels the acknowledgement that nearly all we saw were fatally spoiled by bad work. There is something in plant tissues besides cell walls, no matter what form they take. Is it still necessary to remove all secondary deposits and bioplasts from the cells before a section is fit for study? We think not. After evisceration by bleaching solutions, plant sections are unfit for scientific study. Yet this fossiliferous work is still shown as something very fine. Put *it, too,* away on the back shelves for the micro-paleontologist; if well balsamed it will keep.

A new species (*Cribraria dictydioides*) from our park is reported on exhibition. Good slides of *Microsporon furfur*, probably the cause of *Tinea versicolor* of the skin, and of *Achorion schonleinlii*, an alleged cause of *Tinea favosa*, or ring worm, both difficult to obtain and preserve, are reported.

We note a marked advance in the preservation of delicate fungi, and of fresh water algæ. Many of these slides retained the natural form and color almost unchanged, and all such were preserved in camphor water one ounce and glycerine about six drops. Wickersheimer's fluid is totally unfit for such work.

A few marine algæ mounted in balsam obtained our sympathetic commiseration that these beautiful "weeds of the sea" should be so viciously treated. No intelligible traces were left of the living things. May our eyes never be asked to witness such relics again. Put all marine algæ in Goadby's solution, and many will be preserved unchanged.

Many beautiful polarizing objects were well shown; the Camdem Society contributed nice work in this line. Æsculine and naphthaline were among the most beautiful, but it is an error to exhibit these thin crystals under the binocular with the *second* eye-pieces, because such displays give bad definition.

Among miscellaneous objects we report slides of young oysters *in motion;* sections of nummulitic limestone, from which the pyramids were built; diatoms covered with iron sulphuret; butterfly scales arranged in beautiful bouquets; micrographs, and the electric spark as developed between two pencil points. In turning from this part of our report we suggest the possibility of improvement in the manner of showing some objects. Expertness in microscopic display is best learned—and perhaps learned only—by *much* practice in the resolution of difficult test objects, because in such work greatest attention to illumination and adjustment of lenses is essential, and when that experience is once thus acquired it influences, for best results, all other displays.

We observed many binocular microscopes badly illuminated without achromatic condensers or an equivalent. This is an error. It is not possible to to get best results with the binocular without a condenser below the stage. In all microscopic work command superabundant light; it is easy to moderate it to suit special wants.

In microscopes some improvements and novelties may be reported for the past year. A small folding microscope, standing very firmly when in use, costing fifteen dollars—exhibited by Queen & Co.—is worthy of report.

All of Crouch's instruments on exhibition, except his largest stand, turn down beyond the horizontal, thus giving great facility for the eye-piece to slip out, and also for observing the stars, advantages not useful in *this* country. His binocular prisms slip entirely out, instead of being checked in proper position by a stop. The fine adjustment is still retained on the end of the body.

Beck has removed the flat foot, of whatever shape, from all of his instruments, and they all stand on three toes, and are therefore steady. His new "International" stand, which was exhibited, presents some improvements of interest. The stage is 6½ inches in diameter, and has ¾ of an inch lateral motion, and nearly that in vertical direction. Motion is given by a screw and rack opposed by springs, which are claimed to obviate loss of motion—a great improvement over his former stages. The stage rotates around the optical axis; and also around its own axis by means of a milled-head pinion, enabling it to be completely inverted, and a graduated circle registers the degrees as it goes round. All the illuminating apparatus, if desired, swings around a centre level with the stage. The obliquity of illumination is registered on a large graduated circle, which is movable up and down, carrying with it all illuminating apparatus. To fix the body in any position a lever handled-clamp is attached to one trunnion. The fine adjustment is retained on the end of the body. If the microscope can be claimed as an instrument of supreme precision, it is wrong to place the fine adjustment on the body. Every time it is moved the magnifying power of the instrument is changed, and an error is introduced, and the microscope is just that much *not* an instrument of precision. Means have been found to remedy that defect, and all possible sources of error should be eliminated from the microscopes of the future, just as soon as means are found to do it.

Another large instrument made by Beck, having a stage motion of four inches in either direction, is reported. The binocular body is carried at the end of a long horizontal bar. As in some other microscopes, the body may be detached when the instrument can be used for dissection. The plan of carrying the body on a horizontal bar is a retrograde step in the construction of microscopes. Only for special purposes such plan has been abandoned by most makers, because steadiness cannot be secured except by great massiveness or by some compensating contrivance.

Zentmayer's improved "Centennial" stand was shown at our meeting. Its new mechanical stage, five inches in diameter, is claimed as the thinnest yet made. Light 70° oblique is admitted beneath it. Milled heads move it vertically 1¼ inches, and laterally 1¼ inches. It may be inverted, if desired, retaining still the object in the centre of rotation of the sub-stage. This point is realised by an ingenious eccentric fitting which carries the stage and does not interfere with greatest stability. The centering of the sub-stage is effected by means compact and ridiculously simple. The plan of swinging the sub-stage is well known and not capable of improvement. It is the most simple plan yet devised for that purpose. The fine adjustment moves the entire body without changing its length. The finish and workmanship, and the motions of this instrument place it in precision, simplicity, and excellence far ahead of all other microscopes at our meeting. Since this microscope appeared at our Centennial Exhibition for the first time, many skillful makers have aimed to receive some of its advantages by ingenious mechanical devices, but none yet have approached its classical simplicity and fewness of parts. This instrument marked a new departure in the construction of microscopes, and without injustice your committee can say no less.

We report two lamps attached to microscopes in place of the mirrors. One was an ordinary Beck's lamp fitted with a carrier for the purpose. It has facilities for centering in all directions. The other, made by Zentmayer, was three inches high—including chimney of blue glass—and about 1¼ inches wide. It could be adjusted without rack in every direction, gives out no perceptible heat of a hot night, and will burn without refilling for six hours. With Wenham's modified binocular prism it gives superabundant light in both fields, with a twentieth objective. With an ordinary prism it fills equally well both fields with all lenses up to a fifth. It requires only a slight addition to the ordinary condenser to make it very desirable. It is elegantly made.

We desire to express gratification and appreciation for the company of our friends from West Chester, Camden, and from Harrisburg, and to acknowledge the additional interest which they gave to the meeting.

In concluding our report your committee would suggest that inasmuch as these annual meetings are strictly social and scientific, and are given at great responsibility and expense, in order for our own better education and to awaken among our intelligent citizens a love for the beautiful things which the microscope can reveal, such meetings be kept entirely clear from all attemps to placard into notoriety either private members or officers of the society.

R. S. Kenderdine,
J. G. Hunt,
T. W. Starr.

Elmira Microscopical Society.—The regular meeting of this Society was held Dec. 2nd, President S. O. Gleason, M.D., in the chair.

Frank Collingwood, C.E., of New York, was elected an honorary member. Letters read from S. H. Gage, of Cornell University, and from J. W. Sidle, of Lancaster, Pa. Dr. Krackowizer appointed essayist for the next meeting. Time of meeting changed from the first Saturday to the last Thursday in every month.

Dr. Ford then read his paper upon "The Relation of the Microscope to the Atomic Theory of Matter," in which he speculated upon the query "can we hope that the microscope will show us an atom, or a molecule?" He defined an atom and molecule, and spoke of the highest magnifying power that had been attained in the best objective that had yet been produced. He referred to Huxley's statement of three years ago, in which he said that if objective makers could not produce lenses that would show the spaces between lines 100,000 of an inch apart, a molecule would never be seen. But in 1880, Helmholtz has seen Nobert's lines ruled 112,000 to the inch, and yet the molecule remains unseen. He spoke of Prof. Rogers' theory, that the probable limit of the eye's capability of seeing is about one 4,000,000th of an inch. He commented upon the wonderful rulings upon glass made by Nobert and Mr. Fasoldt, the latter having ruled lines, by means of a delicate machine, that numbered ten millions to the inch. The maker, of course, had never seen the lines he had ruled, but he knew they were there, because his machine had made them, and were only waiting for some objective to reveal them. His band of 90,000 to the inch had been seen by many microscopists. The striæ upon the *Amphipleura Pellucida*, numbering 132,000 to the inch, are now plainly resolved by the best objectives of wide angular aperture. This is the best that has so far been accomplished, leaving the resolution of the molecule a thing to be accomplished in the distant future.

He next dwelt upon an easy method of determining the amplifying power of an objective, by means of the *camera lucida* and the micrometer slide. Gave examples of the relative magnifying power of the highest objective.

Liebig says of the atomic theory that, "the chemist merely maintains the firm foundations of his science when he declares the existence of physical atoms and molecules as an incontrovertible truth," although, like the ruler of Fasoldt's lines, he has never seen them, but just *knows* they are there. Prof. Helmholtz has determined, approximately, the diameter of a single molecule of water, which he estimates at one 250,000,000th of an inch. The Professor then described Helmholtz's method of measurement by means of a soap-bubble and the wave-lengths of light.

He next commented upon the construction of our present lenses and of the microscope of the future, with possible diamond and sapphire lenses, possessing greater refractive power, but leaving his attentive audience to infer that an atom and molecule would probably never be revealed, notwithstanding the great improvements likely to be developed in microscopic objectives.

At a late hour the society adjourned, with thanks to Prof. Ford for his instructive and interesting lecture.

The next meeting occurs on the last Thursday in December, at the same hour and place.

THAD S. UP DE GRAFF, Sec'y.

Wellesley College Microscopical Society.—The second regular meeting of the Wellesley College Microscopical Society was held Monday evening, Dec. 13th, the President, Miss Hayes, in the chair. The following papers were presented:

A paper on the Yeast Plant, by Miss D. F. Waterman; also a paper by Miss E. Hurll, on the Detection of Forgery by the aid of the Microscope.

Professor Nunn gave an account of a discovery she had lately made of the generation of amœbæ, in a remarkable manner, from an infusion of the yolk of hen's egg, in Pasteur's Fluid. In about ten days, and when the odor of decomposition had begun to be quite strong, amœbæ were found in such abundance as to form a creamy deposit on the surface of the liquid; and a drop examined from any part of the fluid showed hundreds on the field. They varied greatly in size and had a remarkably active amœboid movement. Generally a nucleus in vacuo could be distinctly seen. They seem not to make their appearance in water and egg alone, and apparently flourish best when ammonium tartrate is replaced by pepsin. The whole history, whether they originate from white or yellow yolk, and in what manner, has not been ascertained, but it would seem that the matter involves questions of considerable interest.

There were shown under the microscope

1st. Specimens of the Yeast Plant.

2nd. True and forged signatures, showing the particulars in which they differ, not discernible to the naked eye, but easily seen when subjected to the microscope. L. F. CLARKE, Cor. Secretary.

Microscopical Society of Central Illinois.—The third regular meeting of this Society was adjourned from the 11th of November, to the 18th, to enable some of its members, who were attending the Tri-State Medical Association, in Louisville, Ky., to be present. The paper for the evening was prepared and read by Dr. Matthews, the President. The subject, "The Science of Optics as Applied to the Microscope," was well handled.

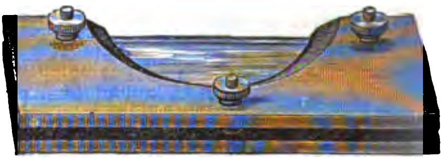
The doctor has made this subject his especial study. His elucidations were clear and thorough. His blackboard illustrations were very fine.

A number of interesting objects prepared by the members were then examined.

The instruments in use during the evening were by R. & J. Beck, and Crouch, of London, and by Kopler, of Washington, D. C.

Current Notes.

A Simple and Convenient Zoophyte Trough.—Every one knows the difficulty of cleaning the common zoophyte trough after water has been kept standing in it for some time, and to most of those who have used the trough to any considerable extent the difficulty of repairing it when broken is familiar knowledge. To avoid these difficulties, Mr. Walmsley, whose skill as a preparer is well known, has devised the little piece of apparatus shown in the annexed engraving. We have here a zoophyte trough which can be taken entirely to pieces in a few seconds, so that the glass plates may be carefully cleaned and then the whole may be put together almost as quickly as the pieces were taken apart. It consists of two glass plates which are separated by a semi-ring of vulcanized india-rubber, against which they are squeezed so firmly as to be watertight, by means of two vulcanite plates, held together by screws with milled heads. It is evident that the front plate may be made of glass of any degree of thickness, while the depth of fluid employed may be regulated by the thickness or number of semi-rings of rubber placed between the glass plates. Other points of value will readily suggest themselves to those who are in the habit of using an accessory of this kind.



EXCHANGES.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

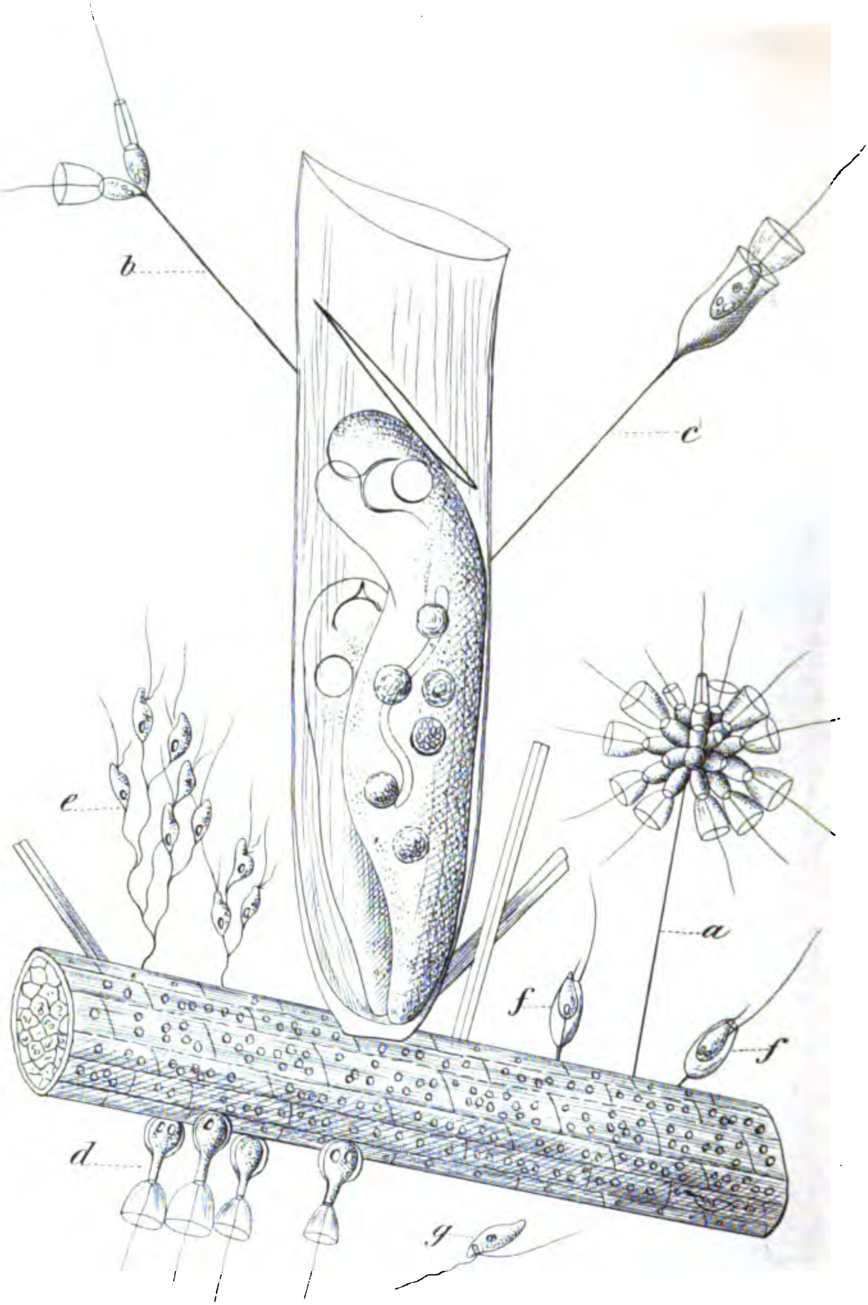
Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., care Editor this journal.

Contributions to the Extinct Vertebrate Fauna of the Western Territories, by Joseph Leidy, Vol. I, in exchange for a similar work on Botany. F. O. Jacobs, Newark, Licking Co., Ohio.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

A good microscope, costing $136 in Paris, in exchange for a good working spectroscope. Address "Spectroscope," care American Journal Microscopy, 14 Dey Street, N. Y.



CHOANO-FLAGELLATA. S.K.

THE AMERICAN
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Vaginicola Valvata.[*]

BY HENRY MILLS.

IN the examination of a species of Nitella, supposed to be *Nitella Flexilis*, sent to me from Hamburg, in this county, I found among other things of interest, one of the Vorticellina, called *Vaginicola Valvata*. It is about the 1-75th of an inch in length, and about the 1-300th of an inch in width, enclosed in a sheath or tube. This tube has a spring valve attached to the upper inside so that when the animal draws itself into the sheath, the valve shuts down at an angle of about 45°, thus securing the inmate from intrusion from the outside world. When it extends itself for the purpose of obtaining food or oxygen, which it does by the play of its cilia, it moves out gently, pushing the valve on one side with its head, and thus opens the door of its house. When in full play, the body is elongated to nearly twice the length of the tube.

Upon the least disturbance by contact with foreign bodies, or the capture of food, it instantly contracts itself, and retires, the spring closing after it. The London *Quarterly Journal of Microscopical Science*, for 1869, has an able paper on the life history of this animal, written by J. C. Muller, Esq. He does not, however, appear to have had a very clear idea of the valve, as he does not mention it, but gives rather incorrect drawings of it. In nearly all the specimens which I have examined, I found one valve so well defined that no mistake could be made in the interpretation. The Micrographic Dictionary, taking its classification, I suppose, from Claparede and Lachmann, places it in the 9th genus of the vorticellina; the 8th genus being the cothurnia, which it resembles in some particulars. Both genera have a sheath, and are attached to it by a flexible and elastic stalk. The difference being that vaginicola is attached to the base, while cothurnia is attached to the side of the sheath.

Mr. Muller says, in the paper referred to, that he found it in October in brackish water. He watched specimens under the microscope for several days, and learned a great deal of their manner of increase which is mostly by self division. The animal is fastened at the bottom of the sheath, as we have said, by a stalk. At the base of the animal, where it joins to the stalk, may be noticed an enlargement, and ultimately a conical fissure, which, in a few hours, becomes longer and larger, and at last divides the creature into two parts, which soon become two distinct and perfect animals, occupying the same sheath side by side, one being usually a little longer than the other. In a little while, he says, one of the two will retreat to the base of the sheath, and there undergo such a change in form and character, as to be able in a short time to leave its companion in the sole possession of its domicile, and go swimming off, to use his words again, "a free and independent animal." After a while it rests upon a piece of conferva or alga, to which it attaches itself. Soon, the material for the formation of the very hyaline tube and valve is secreted and brought into shape by a process, I think, never witnessed, and not easily understood or accounted for; at length, we have a perfect animal, sheath and valve; the animal soon to be divided and send off another, and so on.

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[*] Read before the Buffalo Microscopical Club, Dec. 14, 1880.

W. Saville Kent, in his great work on the Infusoria, places vaginicola in the 1st genus of the 2nd sub-family (vaginicolina) of the vorticellidæ.

NOTE.

The second part of W. Saville Kent's Manual of Infusoria, has a fly leaf attached to it, with a pen and ink sketch of this same vaginicola, made by Mr. Kent himself. He found the animal on a leaf of *Myriophyllum Spicatum*, which was sent to him by Mr. Bolton, of Birmingham. The drawing is made under a magnifying power of 700 diameters, and is a very accurate representation as enlarged to that extent. On the same leaf, as on the animal itself, he found and has figured some of the Choano-Flagellata, which are so fully described, and so beautifully illustrated in his Manual. It may be worthy of remark, that I found some of the flagellate protozoa in bunches of from two to eight, very similar in everything, except that they had no "collar" or wine cup, and that they had three flagella. No increase of power or variation of light would reveal the "collar." These were found on the Nitella in about the same relative positions as those found by Mr. Kent.

EXPLANATION OF PLATE.

Centre figure. Vaginicola valvata on Myriophyllum spicatum.

a. Codosiga botryttii. Pl. ii, Fig. 22-29, and iv, 6-10, (Manual of Infusoria).

b. Early growth of same species.

c. Salpingæca Boltoni. SK. Newly discovered species.

d. Salpingæca amphoridium, Pl. v, Fig 1-9.

e. Cladonima laxa. SK. Pl. xvii. Fig. 5-7 also, as Anthophysa laxa, *Monthly Microscopical Journal*, Dec., 1871.

ff. Bicosæca lacustris. Jas. Clark, Pl. xviii. Fig. 13-19.

g. Heteronima caudata. Pl. xxiv. Fig. 1-10.

[As the figure alluded to by Mr. Mills is a very interesting one, we have reproduced the whole sketch sent out by Mr. Bolton, although, as the above explanation states, it contains figures of several objects not described in Mr. Mills' article. ED. AM. J. MIC.]

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The Inventor of the Binocular Microscope.

BY F. H. WENHAM.

IN a letter from me, appearing in the *English Mechanic*, last summer, I desired that some memoir should be written concerning Prof. Riddell, as the undoubted first inventor of a practicable binocular microscope. In addition to this, I wrote to a friend in America* suggesting that he should seek for records concerning the ingenious Professor. I mention this, that I may be exonerated from any charge of suppressing facts, and claiming undue credit for what I may have done towards improving the instrument.

Prof. Riddell's invention was so original that its announcement came upon us all as a surprise, as it was based upon a principle not before thought of, or known to be possible—that of virtually enabling both eyes to see through the same object-glass.

Probably in consequence of my notes, this history has now appeared from the pen of Col. Woodward, who has taken up the duty with a sternness of decision, that concedes no quarter to those who have followed, and presumed to modify the construction of the original instrument. Before writing his article, Col. Woodward would have done well, to have made himself better acquainted with the particulars of the improvements effected by others. He first makes Nachet the subject of his somewhat hard criticisms. Now, this ingenious optician in his first adaptation of a single triangular prism for dividing the rays, instead of the two prisms of Prof. Riddell, made a notable improvement; the construction was simplified thereby, and the rays of the object glass divided with a knife-like precision by the edge of his prism, thus saving the loss by the two approximating edges of the prisms of Riddell. This was no copy, as Col. Woodward infers, but a decided advance upon the recognised instrument of Riddell.

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* The Editor of the *American Monthly Microscopical Journal*.

In Nachet's later instrument, he adopted only one pair of Riddell's prisms for one tube, using direct vision with the other, but by dispensing with half of the arrangement, having only one dividing line across the object glass, this simplification of the original plan must be considered as a real advance, and by instantly shifting the prism so that the rays cross or pass over to either eye, giving either steroscopic or pseudoscopic effect, as desired, without affecting the simplicity of the arrangement, is an advantage only to be seen to be appreciated, and is the one best suited to the short bodies of the continental microscopes. Previously to this arrangement, I had anticipated Nachet, by the direct vision in the main tube, which has become the form now so universally adopted, that I can well afford the supercilious criticisms of Col. Woodward. It is the fact of retaining the direct tube intact for single vision, in which the main value of my instrument consists.

Col. Woodward mentions my previous binocular with an achromatic refracting prism, as if it were a failure; as he has probably never seen one, this notion may be excused, but the fact is, that in performance it is scarccely inferior to any, and I would still recommend it to any one perverse enough to prefer a pair of inclined tubes to be slipped on in place of retaining the standard direct tube intact and ever ready for use.

However willing Col. Woodward may be to attribute the invention of the "full aperture prism" to Prof. Abbe alone, yet, in doing this, as at the conclusion of his paper, he again fails in the historical part of the subject, which, if he had read up, he would have seen my description of the construction and effects of the prism published many years ago, and of which a number have since been fitted to microscopes.

Concerning Objectives of Wide Angles.

A RECENTLY published article attempts to discuss this subject, and as the matter is one of the utmost interest and importance to all who use the microscope for study, or for aught but amusement and exhibition, it may be well to discuss it a little further.

One sentence, and this gives the key to the animus of the article, reads: "Not long ago a gentleman remarked to us that he thought it was about time for somebody to put an end to the *absurd* and *extravagant* (italics mine) writings, in which a certain class of microscopists have lately indulged, concerning the value of very wide angular aperture, and unusual magnification."

This is a challenge to the writers to defend their advocacy of very wide angular aperture—but coupled with a different matter, unusual magnification—for it is a remarkable fact that many, if not all of the recent writers on the subject, have given as a reason for the use of the "very wide" angle objectives, that they are a substitute for great magnification, or for very high-power objectives.

I call this a challenge, and it is one, and one that should be taken up; but it is issued in such phraseology that no one who has written on the subject can feel called upon to accept. For what writer who has published any "writing" will be willing to "write himself down an ass" by acknowledging that what he has already written is absurd and extravagant?

If the gentleman who made the suggestion, or any other, will specify the absurd and extravagant writings, then, undoubtedly, the writers will be ready and willing to give reasons for their faith—if they have not already done so. But it is a little too much to expect that A will assume that B was the absurd writer, and defend him; or that B will assume in the same way that M is the extravagant one, and so feel it his duty to defend him.

Such a wholesale grouping of all the advocates of a certain class of objectives as absurd and extravagant, has an effect, to a certain extent, for it impresses those who have not investigated for themselves, that there must be something in it.

It is much to be hoped that all the microscopists who *use* the wide-angle objectives will give their opinions, for the question is important, and ought to be put an end to for the benefit of all those engaged in, or about to engage in, studies requiring the use of the microscope, so that they may have a guide as to what they shall procure.

The question which has been put is this: "What new discoveries or new observations have you made with your fine objectives?" It is important, and ought to be answered by each in his own specialty, for it is not to be expected that anyone is a master of all departments. New *discoveries* by the microscope are as rare as new discoveries in mechanics, but new *observations* are made nightly.

The era of *very wide* angled objectives commenced with Chas. A. Spencer, about 1850. The value and importance of wide angles was well known previously, and had been amply written about. The literature of the microscope, since Spencer's advent, has often referred to the observations made with such lenses. It is only needful to refer to the writings of Prof. J. W. Bailey, more recently to those of Prof. L. S. Beale, still later to those of Dr. J. J. Woodward; especially to those of the Rev. W. H. Dallinger and Dr. Drysdale, who, I believe, have made the most valuable "discoveries and observations" in biology on record, and only by the use of wide-angle lenses, with great magnification. I can also refer to the report by Dr. H. J. Detmers on the diseases of swine—in his report to the Department of Agriculture, 1878.

As suggested above, each microscopist can be expected to reply to the challenge only for his own work. For my own specialty—without admitting that anything I have written is absurd or extravagant—the histology[*] of the diatoms, I can say, positively, that the wide-angle objectives have almost revolutionized the knowledge of this order of algæ, since Spencer made his first 175° air angle lens. The figures and descriptions of the older writers, Kutzing, Ehrenberg, Wm. Smith, Gregory, and Greville, are inadequate to represent what we know and can see now.

Other points named in the paper under consideration may be referred to, as they refer to what is the object of microscopy, and what the microscopist should do or get to accomplish his ends. The writer suggests that "the wide-angled lenses have accomplished nothing as compared with other lenses of equal excellence, commensurate with their cost, and there are but few, comparatively, who need the special advantages which the greatly increased apertures afford, and when the choice of the student, whose means are limited, is between a 1-6 inch at $34, and a better one at $70, the cheaper lens will always be sold, unless the other can be shown to be more useful." This passage contains so many things in so few words, that the analysis of it must require many more lines. It certainly needs no argument to prove that those whose means are limited to $34 are more numerous than those whose means are unlimited; ergo, there may be more buyers at $34 than at $70. But the alternative presented is not the true one. The student is not confined to the expenses of $34 and $70, for he may select the same power at $40, or $50, or $15, according to his means or judgment. It is the very object of the discussion to bring up the evidence and testimony of those who know as to which class of instruments is needed by the scientific investigator.

There is a prevailing want of information in regard to the comparative *cost* and the comparative performance of optical instruments. A gain of ·10 per cent. in the performance of *good* instruments cannot be expected short of 100 per cent. in the cost. In this estimate I do not include such lenses as are "manufactured by the hatful" by rule of thumb, as too many are, but only such as are made by the masters, by long and tedious labors and trials, by daylight and lamplight.

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[*] Some people think the study of the diatoms consists in making out superficial marks, lines, striæ, or beads. I go deeper, and with high-angle lenses attempt to know the intimate construction of the valve, of the cellules, striæ, etc.—true histology.

The question was asked one of the most illustrious makers of telescopes now living, "Will a telescope of 25 inches aperture be 25 times as efficient as one of one inch aperture?" His reply was: "It is doubtful." Now, when it is remembered that a 25 inch object-glass is not merely 25 times larger, but 600 times—i.e., it collects 600 times the light, and costs more than 600 times the money—it will be seen that a little gain is to be obtained only by a large expense. Yet the astronomer appreciates and values this gain, and is willing to incur almost any cost to secure it.

It is just the same with the microscope. The scientific investigator values every increase of performance.

The article in question then says, "that one of the greatest improvements in the microscope that has been made since Lister's discovery of aplanatism, is the application of the principle of homogeneous immersion." (For the *origin* of that principle see *Monthly Microscopical Journal*, London, Aug., 1871, p. 214.) Now, *nearly* the whole merit of that principle is due to its property of admitting the extreme angular aperture!! which the writer contends is of no advantage "commensurate with its cost." He may reconcile the contradictions: Either the homogeneous principle is of advantage "commensurate with the cost," or it is not one of "the greatest improvements."

He admits, "It is true they are in certain respects superior to the latter (i. e., the narrow angle), but it is no less true that their superiority is confined within such narrow limits, that only those who are engaged in work that requires just those qualities will find such objectives to be worth their additional cost." "It is to be understood that we refer to persons who are engaged in what is justly called scientific work." This statement of principle and its teaching, to those about to engage in "scientific investigations," is one common to many, but one that I hold to be entirely erroneous, and its advocates false teachers and misleaders. It is time that the question between wide and narrow angle lenses should be put an end to, and, therefore, the advocates and believers of either should present their demonstrations. It is useless for anyone to express an opinion on the wide-angle lenses unless he has actually worked with them. What is scientific investigation? Is it not to elicit the truth, and the whole truth? I do not understand it to be merely to see something described in "the books," which are usually behind the time, but to learn if the books have told the whole story.

To learn this the investigators should use the best appliances of objectives, stands, and apparatus that art affords. It is, then, possible that the wide-angle lens will show no more than the "narrow angle one of equal excellence," and that is as much a contribution to science as a new discovery; it is the discovery of a new fact. But until the student has *used* (not merely looked through for five minutes) the wide angles, he remains ignorant of the question whether there was anything beyond his ken or not.

In judging of the comparative value of any specified lens, the mere vision of an object is not the whole. One lens may show the same far *better* than another, and that is a true test of superiority. C. S.

Shallow Tin Cells.

BY ALLEN Y. MOORE.

FOR some years past, I have made use of a form of cell which is at once cheap, easily made and durable, and as I have never seen a description of it, I beg leave to describe it for the benefit of those who desire a cell which can be made and finished in fifteen minutes.

Of deep cells, I have nothing to say, except that too much care cannot be taken in their making; and the manipulator should always bear in mind that if a specimen is worth mounting at all, it is worth putting up in a proper manner. This also applies to shallow cells, as well as to *every* form of mount.

A cement cell requires considerable time to dry, and even shellac takes longer to harden than is usually supposed. Therefore, a cell is required which is easily made and which may be used immediately. The only cell that I know of, which answers this purpose, is the tinfoil cell. I make them in the following manner:

Flood a clean *warm* slide with lacquer, (a weak solution of shellac and alcohol), allowing it to drain from one corner as a photographer does the negative plate when flooding it with collodion. The heat of the slide causes a rapid evaporation of the alcohol, leaving a film of shellac on the slide. Now, have ready a piece of clean flat tinfoil, a little larger than the outer diameter of the cell required. Heat the slide till the film of shellac is melted, taking care not to boil it. The foil should then be placed upon the centre of the slide, and firmly pressed against it, so that it may adhere at all points. In a few minutes the slide will be cool and the foil firmly adherent. It may now be placed upon the turn table and with the point of a sharp knife blade, two clean cuts should be turned through the foil—one for the outer and one for the inner edge of the cell. As soon as the cuts are made, the superfluous tin should be scraped away, and the slide cleaned with alcohol—it is then ready for use. The cement is hard, and no time need be wasted waiting for it to dry as in ordinary cells.

I send you with this, a preparation of *Trichophyton tonsurans* in which the tinfoil cell has been used. It certainly looks as neat as any other kind of cell, while it presents facilities for sealing which most of the plain cement cells do not possess. The slide sent is a glycerine mount.

Cleveland, Ohio, January, 1881.

[The slide received from Mr. Moore not only presents a handsome appearance, mechanically, but seems to serve admirably the purpose for which it was intended, as the preparation is in fine condition. Tinfoil is so easily cut with any sharp tool that no difficulty can be found in "turning" it up on the turn-table, though for this purpose the "spring" or electric turn-table would, no doubt, be the most efficient. We have a small electro-magnetic turntable, on which, when driven with two carbon cells we can turn *wooden* cells.—Ed. Am. J. Mic.]

New Freshwater Sponges.*

BY HENRY MILLS.

I HAVE to call the attention of the Club to a new variety of sponge found in Niagara River in October last. In the paper which I presented to the club on sponges some months ago, I said we had found only two varieties, both belonging to *Spongilla Fluviatilis*. This third variety belongs to the type *Spongilla Lacustris*. The great difference between the two types being that all the species included in S. Fluviatilis have the walls of the ovarian capsules made up and strengthened by birotulate spicula placed side by side radially. In all the species included in the type S. Lacustris, the capsules have a more leathery covering, and the spicula peculiar to them are neither birotulate, nor do they pass through the walls.

The spicula in this type are either straight or curved, and are arranged at right angles to the radius—in other words they lie flat on the side of the capsules. In the specimen before us, the spicula are very slightly curved, blunted at the ends, and thickly spined. The ovarian capsules lie closely matted together in almost regular order, with but a thin skeleton, which, in my specimen, is mostly washed off. Sometimes the spicula of other varieties growing near by, get mixed with these, so that without care one might be misled in some of his conclusions. It does not grow in these water larger than a large cent.

It is a very beautiful and interesting specimen. The foramena of the capsules are on the upper surface, and have the appearance of broken tubes. I call this specimen No. 3, provisionally.

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* Read before the Buffalo Microscopical Club, Dec. 14, 1880.

Growing close to it I found a mere fragment of another species, which I think is identical with a specimen sent to me by Mr. Dawson, of Montreal, and which he has named S. Ottawaensis. If this is so, we have four species growing within our city limits.

[Since the above was read before the Society, I have corresponded and exchanged slides with Mr. Edward Potts, of Philadelphia. Of the six beautiful slides which he sent to me, only one is identical with any of ours, and that is what I call my No. 3. This has been found in Philadelphia and named by Dr. Leidy, *Spongilla Fragilis.*—H. M.]

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The Awards at Great Exhibitions.

THE following pungent, but accurate description, of the methods of award pursued at too many of our great exhibitions, is translated from a recent issue of Dr. Pelletan's *Journal de Micrographie:*

Allow us, now, to finish this review with a little story, which, while irrelevant to the matters in hand, may serve as a reply to various questions that have been addressed to us in regard to the fact that such or such a constructor or optician did not figure in the last or recent Exposition. Besides, it justifies the attack, violent enough, we confess, that we made in 1878, against the exposition juries, which are too often absolutely incompetent.

Here is our little story then :

Among the exhibitors at the exposition of 1867, there was a famous constructor of optical instruments, one of those, certainly, who put the most careful work into everything they undertake, and who only allow perfect work to come from their shops—it was Dr. J. G. H. During the whole exposition our constructor was at his post, thinking that one day or other the jury would come and examine his instruments.

But it was a vain hope—not a single member of the jury ever appeared before the show case of our exhibitor, whose key, during all those long months, remained in its owner's pocket. But this did not prevent Dr. J. G. H.'s learning, with astonishment, one fine morning, that the distributive justice of the commission of rewards had decreed him a BRONZE MEDAL.

"If a competent jury," said he, "had examined my instruments ; if it had studied them, tried them, compared them with those of my competitors, and if from this labor it had resulted that I only deserve a bronze medal, I should have bowed to and accepted the decision of the commission, and its medal. But the instruments have not been taken from their case ; no one has seen them, studied them, tried them, nor compared them—how can it be that anyone should know that they deserve a bronze medal rather than a pipe of tobacco ? I'll have none of it !" And Dr. J. G. H. refused the bronze medal. But in 1878 the commission noticed that the skilful constructor had addressed no request to them, nor presented any piece of work;—he did not exhibit.

This abstention on the part of a man known to all the scientists of Europe, made a certain noise—so much so, that one day an Academy Inspector, a distinguished physicist, as well as a very good man, and whom we are lucky to have had formerly as professor of physics at the Lyceum St. Louis, M. Q., sought out the constructor, asking him the causes of his regretable abstention, which would leave a sensible void in the French part of Class XV. To whom the latter answered by the story of his little adventure with the jury of 1867.

Swearing, but a little late in the day, that they wouldn't catch him at it again, M. Q. insisted, prayed, answered for it that this time the jury should act seriously, and would actually examine all productions exhibited. It was in vain.

Several times the Inspector returned to the charge—so effectually that at last Dr. J. G. H. gave his *ultimatum.*

"Well, I consent. I will exhibit, but on the express condition that they shall *make a* *written agreement* that my instruments shall be examined, tried and compared; if not, no!"

The thing was difficult and dangerous; so M. Q. took himself off, and did not come back. And that is why Dr. J. G. H. did not exhibit in 1878.

This is what will end, soon or late, by ruining the prestige of expositions, juries, medals—that one of two things, either the commission on rewards acts, or it does not act. If it does not act, the rewards are given to Tom, Dick, and Harry (particularly to the friends of the members of the jury); if it acts, in most cases its members are absolutely incompetent. And if, accidentally, some of them are competent, they are the commercial rivals of the exhibitors whom they have to judge—and in either case, the rewards are distributed in a rediculous manner.

So we understand these absences; we even wonder why they are not more numerous, for we have followed closely the operation of the jury in 1878, and particularly that of the jury of the class which contained the microscopes, especially the objectives. There, also, we saw cases which had not been opened, instruments which had not been examined (which did not prevent certain awards from being made). There, also, we saw members of the jury who were completely ignorant of what they had to pass judgment upon, and, for example, did not know what a "correcting" objective is, nor "what it is for." And they want men like Prazmowski, Powell & Lealand, Tolles, Spencer, and other famous opticians, who are the foremost in the world, to come and submit their masterpieces to the appreciation of a lot of good people who understand nothing about them, and who pretend to pass judgment upon them, and reward each according to his merits—merits of which they have not even a notion, and which they are incapable of understanding. So if Tolles, Powell, and the others, refuse to submit to this humiliation, are they not completely and absolutely right?

But we have allowed ourselves to be drawn further than we intended, and that made us forget what we had to say—we wanted to recall that there is now at Brussels a magnificent exposition. We wish, without, however, being too confident, that the commission of awards will be more competent than those of Paris in 1867 and 1878, and we hope to be able, in our next number, to commence a series of accounts of the part of that exposition which comes within the scope of the *Journal de Micrographie*.

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Microscopical Examination of the Clays in the Comstock Lode.*

BY MELVILLE ATWOOD.

As a preliminary to a statement of the results of my examination of the Comstock clays, I wish to say that I firmly believe that had the clays of the Comstock been carefully studied years ago, by the information obtained from that source, much time, and large sums of money, might have been saved in the discovery of the different large and rich ore bodies, and that even at this time a knowledge may be gained in that way which would greatly assist in directing the search for fresh or undiscovered deposits. For those in charge of the mines to acquire a correct knowledge of the character of the enclosing rocks of the lode, and the true condition of the mineralized silver and gold in the lode, would appear absolutely necessary for the successful extraction and milling of the different ores. These are comparatively inexpensive means of obtaining information, but nevertheless of the greatest importance. For instance, we frequently hear of rich strikes of "green chlorides" in some of the mines. Now, if such ore was really met with, the treatment of it in milling by "wet-stamping" would be attended with the same results as that of wet stamping "black copper ore"—the loss of the greater portion of it. It does not appear very creditable, that after 20 years of mining and milling on the Comstock that there are not wanting those who hold that a large portion of the gold found in the lode exists in a mineralized condition. Indeed, the way, so far as I can understand, in which they estimate their loss on treatment at the Comstock mills, greatly favors that idea—the result of the cleaning of the mortars not being added to the battery pulp assays, so that they do not obtain a fair return of the gold contents of the vein-stuff under treatment, and consequently cannot correctly estimate their loss. At the different California quartz mills, a large proportion of the gold is usually found in cleaning out the mortars; so much so, that not long ago, at one of the mills in Mono county, it was found necessary to make use of a small bar and sledge hammer to loosen the gold, which had accumulated in such quantities in their mortars. In the Virginia part of the lode, as late as May, 1859, and before the discovery of silver in that portion of the ground, the cradlings from the croppings of the lode, was pounded in mortars with mercury, and the amalgam so obtained when retorted, was, I am informed, sold for from $6 to $8 per ounce. The gold can now, by the aid of a batéa, be washed out from the ore taken from the deepest workings: No. 1—Specimen of Comstock ore, with gold from the croppings of the Mexican mine, taken out of Comstock rocker June 22d, 1859. No. 2—Comstock ore, with gold from the fifth gallery of the Ophir mine. No. 3—Comstock ore taken from the deep workings of the Consolidated Virginia mine. No. 4—Gold mounted on slide, which was panned out from a small quantity of No. 3 ore. The Comstock gold is very much alloyed with silver, and consists of gold, 55.37; silver, 44.93. The clays of the Comstock are found on the foot, and what is called the hanging walls of the lode, and from the "sides" of the rich ore bodies met with in the different branch ore fissures, also occupying the upper portions of such fissures or rents where there is no ore except the small rounded pieces mixed with it. It is very evident that the clays were formed subsequent to the quartz-vein-stuff, and most likely by the circulation of heated waters acting upon and decomposing parts of the enclosing rocks, and the rounded character of some quartz-vein-stuff and country rock, met with in the clays, was the result of the mechanical wearing from the movement of the heated waters. The rounded pebbles of quartz with ore in them are found in such positions that they must have been brought up from greater depths. The same may be said of the pieces of country rock, which in many cases were not the same as that "cheeking them," or at the same level. The clays which I examined were taken from my private collection. Unfortunately, I had not any from the foot-wall. The way in which I made the examination of the clays was, first to place them in a porcelain dish, pouring hot water over them and keeping them in the water for several hours, stirring occasionally, till all the particles that would dissolve were taken up by the water. Afterward I emptied the contents of the porcelain dish into a batéa, allowing everything that was dissolved to float away. By the batéa the pyritic matter and other heavy bodies were separated from the rest of the coarser, rounded, and lighter fragments of vein-stuff and country-rock. The pyritic matter is then tested for gold, silver and tellurium, and also a microscopic examination of it is made under water. The fragments of country rock and vein-stuff are then washed again, using a brush to rid them of any clay that might still adhere to them. After drying, they are put into a separator having sieves with 30, 50, and 100 holes to the linear inch—a uniform size enabling me to examine them better with the microscope. The fragments that pass through the sieve having 100 holes, I place in a small cell, fastened on the glass slide, and filled with water, which I cover with thin glass—the shape of the fragments are seen much better in this way since by slightly moving the thin glass cover, they can be made to turn and exhibit their forms in different directions. From the larger pieces of rounded country rock met with in the clay, I cut sections. No. 5 is one of them cut from a piece of about 4-10 of an inch in diameter, and which I send for your inspection. The rock from which it was broken is a trachytic-diorite, with a grayish-green ground mass of plagioclastic felspar. It is rich in minute black particles of magnetite. Some of the hornblende is of an emerald-green color, slightly fibrous. There also appears to be little patches of what is called "viridite." The felspar in this rock has comparatively undergone very little alteration. Nos. 6 and 7 are sections taken from the enclosing east and west rocks, of one of the richest ore bodies yet met with on the Comstock. You will see that they are of the same character, and as little altered as that found in a rounded state in the clays, The fact of the trachytic-diorite being found to the east and west of the ore body, and the absence of what is called the "black dyke," goes far to prove, if any proof be needed, that the richest ore bodies of the Comstock, for the most part, only occupy portions of branch fissures, and are not usually met with in the main fissure. I have noticed that rocks on the Comstock, which have undergone the greatest amount of alteration, and in which the felspar is highly kaolinized, are those where the planes in the jointed structure are of an open character, allowing the heated vapors from greater depths to rise through them. I find, that with the exception of some of the larger grains being rounded, that apparently no change has taken place in the iron pyrites during the decomposition of the rocks, of which it formed a small part. The clays contain, on an average, about two per cent. of pyritic matter, about the same proportion as that in the rock before decomposition; the pyrites, in some instances, gave a small return of gold and silver. The magnetite found mixed with the pyrites after panning, I separate by placing the whole in water, and then making use of a small bar magnet. The fine sand which passed through the sieve having 100 holes to the linear inch, contains a large proportion of quartz, and also small calcareous granules mixed with the undecomposed felspar. The fragments of quartz are much corroded. I very much regret my want of adequate optical apparatus, which prevented my making as thorough an examination of the Comstock clays as I could have wished.

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* Read before the San Francisco Microscopical Society, December 16, 1880.

So many of our Society being more or less interested in the examination of mines, must plead my excuse, if any be needed, for calling your attention to a little device which I have lately used with very satisfactory results in my underground examinations. The want of sufficient light has always been felt, and was a great drawback in our underground examinations. In England large-sized candles were purposely made for the use of the underground superintendents. A great deal of skill and practice are required in the management of the candle underground, and by that means the close observer will easily distinguish between the "expert" and the practical miner. The candle is generally carried in the left hand, and the right is used to shade the eyes from the light. My device is a small glass reflector, one of which I submit for your inspection. It fits the hollow of the right hand, and by holding the candle before it with the left, a strong light may be thrown at pleasure in any direction, and to a considerable distance, enabling you to see the roof of the drift, and cross cuts and slopes, which you otherwise would not be able to examine. I carry the reflector in a small pocket in the right-hand side of my underground coat.

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An Ideal Series of Objectives for Microscopical Work.

PROF. ABBE'S enunciation, in a recent article, of the proposition, in substance, that one great objective of a given angle of aperture should, if properly constructed, do all that *any* glass of that aperture will do, strikes me with peculiar force, because I have been leaning to that view myself. It amounts to this, viz.: Angle of aperture determines the power of discriminating minute variations of structure, or of surface in the plane, which is in focus; *ergo*, if the objective is thoroughly well corrected, eye-piecing will do nearly all that increase of power in the objective would do, without increasing or widening the angle.

A practical suggestion grows out of this, which, if it could be carried out by Zeiss, under Prof. Abbe's directions and with his formulæ, would be of interest to the microscopical world. It is, that the true model for a series of objectives would be a list containing the lowest powers that can be thoroughly well made of each of the desirable angles which will combine maximum aperture with low magnification. The series would thus be scientifically progressive. We should then only need to select those which would combine the most desirable *working distance* with other qualities, and the model series would be complete.

Besides the lowest powers, we should want one objective of 40° angle for use with the binocular upon opaque objects. We should want a glass, with nearly half an inch actual working distance, for use with dissecting instruments or with the mechanical finger. Another, with an eighth or a tenth of an inch clear working distance, would be needed for rough examinations of algæ, etc., in the common animalcule cage or compressor, with pretty thick cover glasses. The problem is, What is the *highest angle* consistent with these conditions? Indeed, I do not see why we should not rate our glasses by the angle of aperture rather than by the so-called focal distance, for we should always know what a thoroughly corrected glass of a given angle *ought* to do; whereas, nobody knows what a glass's performance will be, because it is called a "quarter" or an "eighth" under the present nomenclature.

In further elucidation of the matter, it may be well to refer to the tables which the Royal Microscopical Society have published and kept standing in their journal. These tables are based upon Prof. Abbe's notation, and show the resolving and defining power of objectives of various angles, theoretically calculated from Abbe's formulæ. They give, of course, the *possible* performance of glasses, to which objectives will approximate according to the perfection of their corrections and finish. It is easy to see how a series of glasses, constructed upon the conditions which have been stated above, may combine maximum performance in each department of work, with the minimum number of objectives. Thus, the scientific outfit of the microscopist would be made, at once, least cumbersome in quantity, and most efficient in quality. In this way, we should have what might fairly be called an ideal series of lenses.

In practice, the result would be somewhat as follows, viz.: 1. An objective of 40° aperture and half an inch working distance, giving about forty diameters magnification with the ordinary No. 1 ocular, and resolving 38,000 lines to the inch; 2. An objective of 100° aperture and one-eighth of an inch working distance, giving about 120 diameters magnification, and resolving 70,000 lines to the inch; 3. A homogeneous immersion objective of 120° balsam angle of aperture, giving about 300 diameters magnification, and resolving 120,000 lines to the inch. Proper eye-pieces would make these three objectives cover the intermediate magnifications desirable, and the third objective in the list would resolve any test resolved by any glass yet made and in the market; whilst the 40° glass would give all the "penetration" needed for the binocular with opaque objects.—*Hon. J. D. Cox, in the Cincinnati Medical News.*

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Fertilization by Means of Pollen-Tubes.

MR. J. KRUTTSCHNITT, of New Orleans, has been engaged for some years in the study of the pollen of flowers, the formation and history of the pollen-tube and its relation to the theory that each ovule is fertilized by a tube which descends from the stigma, reaches the ovule and enters its structure through the micropyle. His conclusion that this theory is radically erroneous, and that the functions of the pollen-tubes need re-examination, derives its force from the fact that, being an experienced, cautious and thoroughly capable observer, he has enjoyed exceptional opportunities for the study of the subject in plants most suitable for the purpose, and that the uniform result of his numerous experiments has been contradictory to the accepted theory. During the past few years he has examined thousands of cases, and has confirmed his observations in some 500 instances by mounted specimens, which show with great clearness the facts as they existed at the time of cutting the sections. Yet he has seen no pollen-tubes in contact with the ovules, nor anywhere near them, though examined during the times when fertilization must be taking place, if at all. On the contrary, the pollen-tube is always lost sight of near the stigma. The length of the style is such, in many flowers, that the pollen-tube would have a long way to travel to reach the ovule, and the arrangement of tissue is often such that nature would seem to have placed the greatest difficulties possible in the way of fertilization, instead of taking such a direct and certain way as would reasonably be expected. Mr. Kruttschnitt, therefore, concludes that it is next to impossible for fertilization to take place by the pollen-tube coming into actual contact with the ovules, and that, in fact, the whole ovary is impregnated with the substance of the pollen. He seems to suspect that wooden fibres or spiral ducts, leading in many cases directly toward the ovule, have been formerly mistaken for pollen-tubes. All these features are exquisitely shown in a special box of preparations just contributed to the Postal Club.

As to the general proof of the new theory, it must be admitted that the evidence is mostly negative, and that negative is at best a poor off-set for positive proof. That one man, however capable and thorough, has not seen a thing, is overbalanced a thousand times, by the fact that another capable and candid observer has seen it. The first may have taken the chances, however small, which missed seeing that which did exist; the second could not really have seen that which did not exist. Still further observations, therefore, extending over a greater length of time, will be required to shake belief in a theory which has been so long regarded as a fact, and which rests upon the most positive and universally believed statements of fact. On the other hand it must be admitted that so capable an observer, with unlimited opportunities for favorable observation, would be extremely likely to see the pollen-tubes at or near the ovules, if they really were accustomed to reach that locality; also, that there might be danger of mistaking other structures for pollen-tubes at a distance from the stigma, that the difficulties to be encountered by the pollen-tube in reaching the ovule would be very great in many cases, and that it would be almost a miracle if all the seeds of some plants having a vast number of ovules should be fructified individually by separate grains of pollen. It should also be remembered that the statements of early observers are often handed down as facts, without verification, by subsequent writers, and that proof of such a theory as that of the fructification of the ovule directly by the pollen may seem stronger than it is, a great number of statements to that effect resting (possibly) on a much more limited number of really independent statements. The early observations, too, which established the accepted theory, must have been made with lenses of inferior defining power, and without the advantages of staining, which would now render error much more improbable. Furthermore, pollen-tubes may in some instances have really been seen in contact with the ovules, and a general theory have been drawn from the fact, when their presence there was exceptional and not normal, or at least not general. The proof of the old theory is therefore not so positive as it seems ; and the theory must be to some extent an assumption founded upon facts whose significance is not beyond dispute.

Though analogy is often an unsafe argument, the doctrine of fertilization of the whole ovary by the pollen is well illustrated, to say the least, by the ferns and others among the lower plants, which produce fertile spores indefinitely as the result of a single earlier fructification. On the whole, while far more proof will be required to convince the world of the correctness of the new theory, still the very interesting and able studies of Mr. Kruttschnitt seem sufficiently conclusive to call for a reconsideration of the old theory, or, at least, for a revision of the proofs upon which it rests.—*American Naturalist.*

The Artificial Star for Testing Objectives.

MR. WENHAM'S description (illustrated) of the method of testing objectives by means of a small globule of mercury, known as the artificial star, is published in the January number of the *Young Scientist*, and may be had for six cents.

Mr. Wenham's well-known papers on the grinding of glass and the construction of objectives have been published in full in the *Young Scientist* for 1880, and will be sent to any address for 50 cents.

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Our Next Issue.

WE have been obliged to hold over several important articles for want of room, and our publishers' announcement, etc., is omitted for the same reason. The March number will contain an extensive and valuable paper by Dr. Stokes, on Growing Slides, illustrated with nearly twenty figures ; and in addition to these illustrations, we have on hand a remarkably fine plate of the Foraminifera found in the silt beds of March, England The description of the silt beds, etc., is by Mr. Green, of The Cross, and the engraving by Dr. Cuzner, with whose work the subscribers to this journal are not unfamiliar. Altogether, the March number promises to be one of unusual value and interest.

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PERSONAL.—We are glad to learn that our old contributor, Prof. J. Edwards Smith, of Cleveland, Ohio, is again in the harness, having just taken charge of the Department of Microscopy in the *Cincinnati Medical Advance.*

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Our Book Table.

Compendium of Microscopical Technology: a Guide to Physicians and Students in the Use of the Microscope, and in the Preparation of Histological and Pathological Specimens. By Carl Seiler. M.D. Philadelphia: D. G. Brinton.

This is a compact little treatise of 130 12mo. pages. The author has wisely condensed the preliminary chapters, and has thereby obtained room for very complete directions for the preparation and mounting of histological and pathological specimens. In this department of microscopy, Dr. Seiler is known to be an expert, and as he details only those methods and processes which he himself has found to be the *best*, omitting the numerous variations which serve only to confuse the student, he has attained a degree of completeness which would hardly have been expected in so small a volume.

The appendix contains a classification of the more common tumours and neoplasms in tabular form—a feature which must prove of great value to the student.

Ye Microscope of Ye Olden Time: A Lecture Delivered before the Microscopical Society of Camden, N. J., Oct. 21, 1880, by Prof. Edward F. Moody, Ph. D. Published by the Society.

The microscope which Prof. Moody here figures and describes, is one made by John Marshall, of London—the figure being a facsimile of the engraving published in the "Lexicon Technicum." of Harris—1704. We happen to have a copy of this curious old work, and we have also seen one of these microscopes almost the exact pattern of the one figured by Prof. Moody. It was a compound instrument, but instead of having a Huyghenian eye-piece, it had a single lens for the eye-piece, while about midway between the eye-piece and objective was another double-convex lens, called the field-lens. The objective was a simple double-convex lens. This microscope is figured and fully described in Quekett's Treatise on the Microscope.

The pamphlet before us is filled with interesting matter, as the author has carefully searched the pages of the Transactions of the Royal Society, and has given us a great many bits of quaint information in regard to the instruments and discoveries of these early times. Our readers who can procure a copy of this pamphlet will be well repaid by a perusal of it, and although we might not agree with all the author says—as, for example, his attempt to identify the double lens of Divini with the doublet of Wollaston—we cannot help regarding it as a valuable contribution to our microscopical literature.

—We learn that Prof. Chas. H. Stowell, of the University of Michigan, has in press a Manual of Histology for Students. Its issue will be looked forward to with interest not only by students, but by medical practitioners and microscopists generally.

—The third edition of "How to Use the Microscope" is nearly ready. Many chapters of the work have been entirely rewritten, thus causing greater delay than was at first expected. The book will be considerably enlarged, but the price will not be increased.

—We have just received from Mr. E. W. Wheeler, of London, several copies of the last edition of his Catalogue of Microscopic Slides and Preparations. The beauty of Mr. Wheeler's slides are too well known to need comment, and as they can be obtained from most of the dealers in this country, these catalogues would be practically useful as well as of scientific interest to our readers. We will gladly send one to those who ask for them, as long as the supply lasts.

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Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Ten Millions to the Inch.

Ed. Am. Jour. Microscopy.—In an abstract of a very able and interesting address, on page 23 of the last number of the JOURNAL, it is stated that Mr. Fasoldt has ruled lines numbering ten millions to the inch, that the existence of these lines is a known fact, and that they are waiting for some objective able to reveal them. This is an error which requires correction, because such statements, made inadvertently by scholars, are eagerly received and repeated by non-scientific persons, and thus become the foundation for great and lasting popular errors. The coarse bands upon Mr. Fasoldt's excellent plates are remarkably well ruled, and up to 90,000 to the inch the lines have been frequently seen, as stated in the address referred to. A few really competent observers believe that they have resolved into separate lines the bands of considerably over 100,000 to the inch; nor is it very improbable that bands have been successfully ruled which are finer than those yet seen. But it is extremely improbable that lines have been ruled several millions to the inch. It is easy to adjust a machine to any required theoretical fineness of spacing, so that it shall, for instance, ostensibly rule lines ten million to the inch; but there is not the slightest reason to believe, still less to consider it an established fact, that the band thus produced consists of separate and practically equidistant lines, each one of which corresponds to one motion of the ruling point.

P. H. WARD.

Troy, N. Y., Feb. 4, 1881.

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Machilis.

Ed. Am. Jour. Microscopy.—Since the publication of my article on *Machilis* in the November number of your valuable journal, I have discovered that it was unwise to classify the scales of this creature into Dorsal, Lateral and Ventral, although I thought I had good grounds for such reference.

After macerating the dried bodies of two specimens of Machilis in liquor potassæ, and carefully working in distilled water, I mounted the chitinous involucres, flattened laterally, *dry*, upon one thin cover and under another, and obtained an excellent view of the rings, spiracles, and other details on both sides, as also of scales in situ in some places, and of empty sockets in many others.

What first struck me in the objects so prepared, was that the larger scales are generally superficial upon most parts of the body, and on the setæ; that the cordiform, oval or fan-shaped scales in most situations underlie the former, and bear to them the same relation that the downy fur of animals does to their hair; and lastly, that the 'acrodos' form of scale is most abundant, if not confined, to the dorsum and sides of the thorax.

I regret having committed an error which, however, I beg you to aid me in correcting.

CHRISTOPHER JOHNSTON, M.D.

Baltimore, Jan. 15, 1881.

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From a Different Point of the Compass.

Ed. Am. Jour. Microscopy.—Whilst "Eugene *et als*" of Illinois, (JOURNAL OF MICROSCOPY, November, 1880,) get too much "Transactions of Societies," I wish the gentle "zephyrs" would waft more of them in this direction; still I feebly appreciate the other points in said communication.

For four or five years I was member of a Microscopical Society of *two*, since when, have been President, Corresponding Secretary, (at random), and Treasurer of a "Club of One," and although I have tried to bear these weighty honors with due modesty for over forty years, I am unable to get a copy of "Proceedings of National Microscopical Congress, and of American Society of Microscopists, for 1880," not that the Treasury of my Club is entirely depleted, but simply because said Proceedings are *not on sale*.

Will not some one take compassion, and forward a copy to care of ED. AM. JOUR. MICROSCOPY, 14 Dey Street, N. Y., when due acknowledgement will be made by the Society of "Club of One." GREY BEARD.

In the Swamps of Louisiana, Jan. 15, 1881.

[We sincerely trust that some one who has a spare copy of this report, will gratify our old friend.—ED. AM. J. MIC.]

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Buffalo Microscopical Club.—A regular meeting was held Dec. 14, 1880, at the Central School. Prof. Kellicott presided, and Mr. George E. Fell acted in his capacity as Secretary. The usual order of business was gone through with, and Mr. Henry Mills read a paper on "Fresh-Water Sponges and other Objects," which will be found in another column.

Upon the conclusion of Mr. Mill's remarks, quite a little discussion followed.

Mr. George E. Fell then presented a paper "on the Binocular, Microscope, and Stereoscopic Vision." This paper was called forth by a paper presented before the Club at the October meeting, in which it was claimed that no particular advantage was derived in the use of the *binocular* over the *monocular* form of microscope, and that no true *stereoscopic* effect was produced by the binocular form of instrument as used. Mr. Fell dissented from these views, taking, with certain restrictions, entirely opposite grounds.

Mr. Fell, with prepared diagrams, explained the different forms of binocular instruments, and then stated that among the many recurring controversies to which the modern microscopists are subject, this one of superiority or non-superiority of the binocular arrangement over the monocular is not now often met with. His experience has invariably been that the individual who begins his use of the microscope with a monocular, and has become accustomed to the use of one eye for observation, as is generally the case, seldom appreciates the stereoscopic effect produced in the binocular arrangement, when the instrument, usually in the hands of others, is glanced through for a short period of time. We are well aware that defective vision obliterates the effect produced by the stereoscope. He was inclined to believe that a trifling temporary defect of consentaneous focalization may be produced by the continued use of the monocular microscope, so that the microscopist who habitually uses the monocular form of instrument, may be incapacitated from realizing the advantage of stereoscopic vision in the stereoscopic binocular microscope. His own personal experience in the use of the two forms of instrument led him to make this statement, as he had noticed that, after a continued use of his monocular "Acme" stand, it is some time before his eyes become accustomed to the binocular, so that he could satisfactorily experience the full stereoscopic effect.

Mr. Fell stated what he believed to be the proper fields for the use of the two instruments before closing his remarks.

Mr. Fell's paper elicited considerable debate, and it was decided to renew the controversy regarding the points brought up by his paper at no distant date. [We understand that Mr. Fell has in preparation a more extended paper on this subject, which we hope to give our readers in full, at an early day.—ED. AM. JOUR. MIC.]

It was announced that a series of papers will be presented before the Society of Natural Sciences, and that two papers were requested from the Microscopic Club, one to be read in February and one in April. It was decided that Professor Kellicott and Mr. Henry Mills prepare the papers. After some minor business had been transacted, the meeting adjourned.

Jan. 25, 1881. The regular meeting was held at the Central School Building. Professor Kellicott occupied the chair, and the Secretary, Mr. George E. Fell, was at his post.

The name of Mr. John H. Pryor was presented, and he was elected a member of the Club.

Mr. Henry Mills read a paper on the fifth chapter of Kent's great work on the Infusoria. The chapter is devoted to a discussion of the life history of sponges. The following is a synopsis of the paper:

It is now understood by all who have given this subject any thought that there has been a great diversity of opinion among scientific men as to the place the sponge should hold in the place of being. Formerly it was supposed to be of vegetable origin, and it was not until quite recently that its animal origin was intimated. It was left to Grant, Bowerbank, Carter, Clark, and others to produce actual proof of its animal organization. Mr. Mills's paper proceeded with a synopsis of the researches by scientists in different parts of the world into the life history of the sponges and spongilla. The interesting point, however, in Mr. Kent's work, is that many of the late observers disagree essentially with the great German scientist, Haeckel's, view of the subject of the life history of the sponge.

Mr. Kent regards the work of Prof. Henry James Clark, of the Agricultural College in Pennsylvania as an important epoch in the elucidation of the structure and affinities of the spongeidæ. The results of his labors are given in the following words: Summing up the results of his discoveries, the views maintained by Prof. Clark, with reference to the position and affinities of the sponges were that these organisms must be regarded as compound colonial forms of flagellata, whose units in the case of *leucosolenia* exhibited a type of structure essentially similar to that of *codosega*, but might possibly in other instances more closely approximate to that of *monas bicosæca* or *anthophysa*. The new light brought to bear on this vexed question, and the influence exerted upon the scientific mind by the discoveries of Prof. Clark, although great at the time, were doomed for a short time at least to be thrown into the background by the almost contemporaneous introduction upon the scene of a yet more novel, and for the followers of evolution a far more fascinating interpretation of the structure and relationship of these organisms. In the year 1869, Prof. Ernest Haeckel announced in the most emphatic terms that the sponges were more nearly related to the corals, or anthozoain Cœlenterata, than to any organized beings, and that the position hitherto assigned them among Protozoa was fallacious, and could no longer be maintained. In advancing this theory, Haeckel merely revived and clothed in a somewhat new garb a theory that first originated with Ellis and Pallas, but which was rejected by subsequent investigators.

Their theory was given, and its fallaciousness commented on. Mr. Kent's work gave a detailed history of the work of the leading scientists, from this up to the present time on the subject, and proves in a very satisfactory manner that some of the conclusions arrived at by Prof. Haeckel have not been substantiated by facts.

The following gives some of the criticisms or results of same, so far as Prof. Haeckel's labors are concerned.

Thus we see that Prof. Haeckel had to abandon his former line of defence, and depend mainly upon making good his position with relation to the suggested affinities of the two groups (sponges and corals), through the evidence he adduces with respect to the developmental phenomena of calcispongia. The radial aquiferous system of the adult sponge, formerly held so firmly, was found, when put to the test, not to hold water. The new arguments brought forward were based on the composition and significance of certain ciliated and motile reproductive bodies common to all sponges, and first discovered by Dr. Grant, and noticed by other observers, but whose structure and import have not been exhaustively investigated. Prof. Haeckel called them *ciliated larvæ*. The descriptions of these bodies were given in detail. Taken in optical longitudinal section, they presented the aspect of an ovate sac, composed of two separate and distinct cellular layers, the outer one being composed of sub-cylindrical and radially disposed cells, and the inner one of a correspondingly simple layer of larger cells. This bilaminated structure Prof. Haeckel denominated a "gastrula," and represented it to be the *stock form*, from which all sponges were primarily developed. Launching into the region of hypothesis, he (Prof. Haeckel) says: "I regard the *gastrula* as the most important and significant embryonic form in the whole animal kingdom." After further statements regarding Prof. Haeckel's views, Mr. Kent says: "Had these deductions, speculations, and interpretations been founded on fact and actual observation, the metazoic organization and affinities of the sponges would have been established upon a firm basis. The crucial test, however, applied by the independent investigations of Metchnikoff, Oscar Schmidt, Barrois, F. E. Schulze, H. J. Carter, and the present author, have shown that not only do errors exist, but that they are of such a radical and fundamental nature as to lead one to infer, at least, that Professor Haeckel was so carried away in his ardent pursuit of the metazoic archetype, that he lost, for the time, the power of discrimination between matters of fact and hypothesis, and so evolved from his own inner consciousness details that are wanting to complete and perfect his theory." Mr. Kent then goes on to explain and make the grounds which seem to be substantiated by able observers still more impregnable, and he says, "that taken altogether, it is clearly evident that the so-called sponge gastrulæ described and figured over and over again in Professor Haeckel's monograph, are an entire myth, and the superstructure of the gastræa theory, so far is entirely worthless." He then states, that from this it appears that a very considerable portion of Haeckel's artistically-executed plates are worse than useless, they having been reproduced as proven facts in text books of biology. These misrepresentations necessarily justify more than customary precaution in accepting as facts his evidence in other directions, wherever room is left for the slightest reasonable doubt.

At the conclusion of Mr. Mills's paper, considerable discussion ensued. The questioning of the correctness of Prof. Haeckel's deductions by so able authority, and the seemingly positive corroboration of Prof. Clark's views in general by as eminent and almost as well-known scientists, makes the whole subject of interest to the general reader. Prof. Kellicott considered it unfortunate either way, as the demonstration of fallable, or we might term it careless work, by so well known a scientist as Prof. Haeckel, served to shake our faith in the most carefully executed observations of scientific men. Mr. Mills stated that in his observations of some of the important structure of the spongilla, and in the examination of details which have been in dispute, he believed a mechanical stage valuable. He had at one time one of the forms so difficult to clearly make out, under the instrument and just as he was obtaining a satisfactory view of it he had to move the stage a trifle, and, as is often the case, moved his object out from the field of his lens and lost it. A mechanical stage would have enabled him to give a steady motion in any direction.

Dr. Howe was not yet prepared to believe that so thorough a worker as Haeckel would be found presenting erroneous statements in the manner attributed, and Dr. Barrett stated that if the assertions in the work referred to were substantiated, it proved Prof. Haeckel anything but the reliable authority he had always been considered.

Mr. George E. Fell asked Prof. Kellicott and Mr. Mills, who have made a careful study of the spongilla in this vicinity, with which side their observations coincided. Prof. Kellicott stated that all his observations opposed the "gastrula" theory of Prof. Haeckel, and that he had not yet seen a *Monera.* Mr. Mills coincided with him.

Under the head of personal work, Dr. A. M. Barker stated that he had examined specimens of the pork obtained from Erie, Pa., which had caused the death from trichinosis of six persons. He found it teeming with trichinæ, which he noticed were smaller than usual, and not thoroughly encysted. Dr. Phillips had also obtained and prepared slides of this same pork. The subject of trichinosis was generally discussed, much interesting information being elicited.

The Secretary, Mr. Fell, presented some injected preparations from the cat, and referred to the structure of the stomach in being made up of the four coats, viz., the mucous, cellular, muscular and serous. He explained how these coats might be separated, and exhibited slides of the injected cellular coat, showing the great numbers of anastomosing blood vessels of which it was made up, and which serve to supply the mucous coat with its pabulum. Prof. Kellicott called the attention of the Club to a hymenopterous larva of a special type, which can now be obtained from the larvæ of a fly found abundantly in a gall on an upland willow. He exhibited two slides having the larva in question *in situ*—i.e., within the body of the larva of the *Cecidomyice salix valatus.*

Dr. Lee H. Smith stated that his attention had been called to oleomargarine, and that he would present a paper on this subject at the next meeting of the Club.

President Kellicott then gave notice that the next meeting would be the annual meeting of the Club, and the programme as follows: After the transaction of the ordinary routine business, a summary of the past year's work will be given by the Secretary, followed by a paper on the Progress of Microscopy in this city, by the President. The election of officers will then take place. Two tickets will be nominated by the nominating committee. To this meeting, which will prove interesting, the members are requested to invite their friends.

Elmira Microscopical Society.—The Regular Monthly Meeting, Dec. 30, 1880. President Gleason in the chair. The usual members were present and a large number of visitors. Mr. Sexton, of Rochester, exhibited Gundlach objectives and stands to the Society. The American Society of Microscopists were extended an invitation to hold their next meeting in Elmira, under the auspices of the home society. Several members paid dues, and the regular routine of business having been transacted, Dr. Krackowden delivered a lecture on "Atoms, Molecules, Cells."

He spoke of atoms having assumed centres of attraction, one, two, three or more, by means of which they were drawn toward one another to form a molecule. He illustrated the possible motion of atoms, giving light and sound waves as examples.

He aminadverted upon Haeckel's rejection of the human soul, while he attributes one to the atom; also upon the theory of male and female atoms, whose copulation was alleged to explain the birth of the molecule.

No essential difference between a molecule and the primitive cell—an amœba, f. i., *chemically* considered, being but a combination of atoms, and *physically* endowed with endosmosis and exosmosis, whence such phenomena of life as locomotion, alimentation, growth and proliferation—sensation and consciousness *not* being differentiations, but *endowments* of the higher organisms.

Darwinism is *at present* the best working *theory,* since it more readily explains the greatest number of facts in every department of human knowledge than any other. Hence differentiation of all forms of life from simple atoms—the chief changes undergone by some of the typical ones were then characterized according to the data of comparative embryology, from the ovum to birth, and through life up to death. Thus: the human ovum, a primitive cell; the spermatozoon, a monad; the white blood-corpuscles, an amœba, etc.; multiplication of cells and their relations to each other; environment, conditioning, form and function, etc.

Judge Dexter was appointed essayist for the next meeting. Subject, Evolution.

After witnessing the circulation of the white and red corpuscles of the blood in a newt's gills, while the creature was confined in a "live box," the Society adjourned to the last Thursday in January.

The regular monthly meeting was held at the Surgical Institute on January 27th, Dr. S. O. Gleason, the President, in the chair. Fifteen members of the Society present, and twenty-eight visitors.

J. H. Barney, of the Academy of Sciences, invited the Society to be present at a meeting of the first-mentioned body, to occur on Jan. 29th, at which time the Microscopical Society would be invited to become a section of the Academy of Sciences. The President, Vice-President, and Secretary were appointed a committee to represent the Microscopical Society at that meeting.

Letters were read from the officers of the American Society of Microscopists, relative to holding the next national meeting in Elmira.

Judge Dexter then read his paper upon the Hypothesis of Evolution. It was a concise and able exposition of the theory, setting forth in plain terms, and admirably arranged, the arguments of Spencer, Huxley, Hæckel, and others, so that the sum and substance of the propositions of these celebrated scientists were given in one evening; an array of scientific information that would demand months of reading to acquire.

The entire lecture was closely listened to, and gave great delight to the intelligent audience assembled. Judge Dexter was invited to continue the subject at some future meeting.

The paper was discussed by Prof. Ford, Dr. Krackowizer, J. H. Barney, the President, and others. The living monad and amœba were shown under the several microscopes on duty for that purpose. The members and guests having scrutinized their "original parents" to their satisfaction, at a late hour the Society adjourned, to meet the last Thursday in February. Dr. Gleason appointed essayist for the next meeting.

Thad. S. Up de Graff, Secretary.

Rochester Microscopical Society.—This Society held its annual meeting in the Free Academy building. After the regular routine business, the reports of the various officers on the work of the past year, were called for.

The Secretary, Dr. J. Edward Line, was first called on. He reported that the Society had held eight regular monthly meetings in the past year, which were well attended. He presented a list of the papers read before the Society. Of these papers, Mr. Bausch's, Dr. Blackham's, and Dr. Searing's had been published in full and credited to the Society. The second annual soiree was, in every respect, superior to its predecessor. The number of exhibitors were 59; number of exhibits, 132; number of microscopes, 69; number of objectives, 96. The membership reported a year ago was eighty-nine. Since then thirty-two have joined the number, while two have been lost, one by death and one by resignation. The total membership at date is 119, of which 110 are active and 9 honorary. The secretary closed by recommending that the Society get a club room as soon as possible as headquarters for their work and possessions, and returned thanks to Mr. Forbes and Mr. Cronise for favors done the Society.

The Treasurer, Dr. Rider, then reported a balance in the treasury, and that no further assessment would be necessary, unless the Society decided to increase its expenditures over those of the past year.

The President, Prof. Lattimore, then made some remarks appropriate to the close of the year and of his official term. In reviewing their past history he congratulated the Society upon the progress it had made. He attributed much of it to the harmonious feeling which had always prevailed. The papers which had been read before the Society had been of exceptional interest. Some of them had attracted a great deal of attention outside of the city. Then, too, the stimulus which the association had produced in individual effort was healthful and productive. Their exhibits had changed wonderfully since the first meetings. At first they presented the labor of others, now their own work was exhibited. Some of the work done by members of the Society, in mounting objects, was beginning to attract attention among leading microscopists, and when its full import was known it would attract much more. Professor Lattimore then made two recommendations. The time had come, he thought, when the active working members of the Society should select a field in which to labor. They must narrow their research to one subject. Only thus could they accomplish great results. The details of the work would be mastered, and they would be free to observe the more interesting and complex phenomena. He recommended further that the Society sub-divide itself into small clubs of three or four members each for pursuing work in the same field together.

The election of officers was then taken up. Messrs. McGuire and Levi were appointed tellers. The following officers were chosen: President, Rev. Myron Adams; Vice-president, H. F. Atwood; Treasurer, Dr. C. E. Rider; Secretary, H. C. Maine.

During the canvass of the votes for president, President Lattimore exhibited to the Society specimens of trout eggs and shrimps, presented by Mr. Enright of the hatching establishment at Caledonia. President Lattimore suggested a mode of studying the eggs by means of sections made with the section cutter. During the canvass of votes for vice-president, Mr. Maine exhibited drawings of diatoms from the Massachusetts coast. These diatoms were the *Navicula Lora*, the *Navicula Punctata*, and an intermediate form which seemed to indicate that the *Navicula Lyra* was merely a modified form of the *Navicula Punctata*.

On motion of Colonel Greenleaf, a vote of thanks was extended to the retiring president of the Society. President Lattimore acknowledged the vote in an appropriate manner.

On motion of Mr. Dransfield, a vote of thanks was tendered to the Board of Education for the use of the room, and to Dr. Forbes for putting it in order.

In seconding the resolution, President Lattimore spoke of the kindness of the Board, and of the pains taken by Dr. Forbes to render the meetings pleasant.

W. H. Learned was elected to membership.

Mr. Attwood moved an assessment of one dollar to provide for further expenses. After a full discussion the motion was carried.

On motion of Dr. Rider, those who had joined since the summer vacation were made exempt from the assessment.

On motion of Mr. Dransfield, a vote of thanks was tendered to the retiring officers.

A committee of three were appointed, on motion of Mr. Maine, to consider the constitution and by-laws, and report to the Society any needed revision. The committee consists of H. C. Maine, Dr. Charles Forbes, and Adelbert Cronise.

On motion of Horace McGuire, the executive officers of the Society were instructed to report a scheme for the subdivision of the Society for the pursuit of different branches of inquiry.

The Treasurer announced that he was ready to receive the assessment voted.

The Society then adjourned to examine the objects exhibited under the microscope.

Griffith Club of Microscopy (Detroit).—The regular monthly meeting of the Club was held at the society room January 4th. Dr. W. C. West, of Monroe, Mich., read the paper of the evening on the subject of Injecting and Staining Histological Specimens. The Doctor laid no claims to originality, but presented, in a very instructive manner, his experience with the methods of others.

Staining, the doctor said, was a great aid in microscopical research, and many important facts relating both to the structure and growth of tissues had been ascertained by adopting the process. The two chief staining fluids in use are carmine and hematoxylin; all others are of secondary importance. These fluids may be procured of any dealer, or prepared by the microscopist. The fluids may be used strong or diluted with water, and the time required to obtain the desired tint will depend on the strength of the solution. Experience must be the guide with each individual tissue.

To be able to examine the arrangement of the minute blood-vessels of tissues, we must resort to artificial injection. Without this aid we may be led to the most erroneous conclusions, mistaking the collapsed capillaries for nerves and other structures. To make objects entertaining and instructive, considerable skill is required, and to become an expert requires an amount of practice and patience.

The doctor has had the best success with Beale's Prussian blue injecting fluid. It is inexpensive, keeps well, flows readily, and is always ready for use. Beale's acid carmine fluid is also good, but is objectionable on account of its tendency to transude through the walls of the vessels, and stain the surrounding tissues. Both these fluids are what are termed cold injecting fluids, requiring no heat for their use.

Dr. Seiler's carmine gelatin, and Dr. Main's gelatin fluid, are both excellent. They must be used warm.

The injecting is done by a syringe furnished with a stop-cock and several pipes of different sizes, or by hydrostatic pressure. The latter mode is especially adapted to small and delicate organs.

The best animal to inject is the cat. To inject a cat, put the animal under the influence of chloroform, open the chest, cut off the apex of the heart, and after the animal has bled to death, insert and secure the canula in the aorta. Begin with a gentle force, gradually increasing till the peripheral capillaries are seen to be full. The danger of rupturing the vessels is not so great with the hydrostatic pressure apparatus as with the syringe. The veins and ducts of organs may be injected at the same time with the arteries, producing the most beautiful specimens.

The doctor closed by saying that although the time and patience required for good work were great, the results were sufficient to repay the microscopist amply for his trouble.

January 18th the Club held the first of a series of invitation soirees, at Y. M. C. A. Hall. The affair was a success in every way.

At the working meeting, January 25th, the Club mounted some beautifully injected histological specimens, furnished by Prof. C. H. Stowell, of Ann Arbor. C. G. JENNINGS, Sec'y.

Canandaigua Microscopical Society.—The regular meeting of the Society was held Nov. 9th, 1880, at the residence of Mr. M. D. Mungar. The meeting was called to order by the President, Dr. N. T. Clarke, at a quarter past eight.

The Secretary, Dr. John Jewett, read a paper entitled, "The Examination of Animal Tissues under the Microscope," in which the methods of preserving, hardening, cutting, staining, and mounting of tissues were briefly discussed. The paper was very practical, plain and explicit, and just what was much needed, as a majority of the members are but beginners in the use of the microscope.

Under the head of miscellaneous business, the

President suggested that at the next meeting, all of the members come prepared to exhibit some specimen of their own preparation to illustrate their skill in mounting.

Dec. 14th 1880.—The Society met at the residence of Thos. M. Howel, Esq., and were entertained by Major Richardson.

According to appointment, Dr. M. R. Carson read his paper on "Parasites." The substance of the paper was a *general*, in contra-distinction to the *special*, facts of parasitism. Both classes of parasites, internal *Entozoa*, and external *Ectozoa*, were alluded too, but only the *Entozoa* were considered. They were divided into four kinds, named respectively—First, the Cestoidea, which means tape-worms. Secondly, the *Trematoda*, which means fluke-worms. Thirdly, the *Acanthocephala*, which means thorn-headed worms. Fourthly, the *Vermatoidea*, which means thread-worms.

A brief description of many varieties of each of the above kinds, as they are found in different animals, fish, and birds, was furnished, but the most of the paper was given to a careful examination of the history, habits, and life record of the *Trichina Spiralis*, and *Tape-worm*.

After the reading of the paper, the Doctor exhibited a tape-worm of the variety *Tænia Mediocanellata*, which measured fifteen feet in length; also, several Trichinæ, both in the cyst and out; one very beautiful specimen of trichinæ in a minute shred of cat's tongue, prepared and mounted by Dr. Carl Seiler, of Philadelphia. This specimen was interesting not only owing to the trichinæ it contained, but was much admired on account of the beautiful exhibition it afforded of the muscular fibres and papillæ of the tongue. The doctor mentioned that this disease is very common in cats; in fact all cats have them.

Miss Mungar exhibited under her microscope a silk worm. Mr. Backus, fibres of silk, flax and cotton, of his own mounting, also a water tiger that he had obtained from a specimen of well water containing a great number of these creatures, and furnished him by Dr. Carson. Dr. Clarke showed with his microscope some diatoms of the variety called *Bacillaria Paradoxa*, also a transverse section of palm tree wood.

Mr. Backus was appointed to read the next paper.

Central New York Microscopical Club.—A regular meeting was held on the evening of Tuesday, Nov. 30th, at the office of Dr. Aberdein, in Syracuse. Dr. Clifford Mercer, the compiler of the micro-photographic section of the last edition of Beale's "How to Work with the Microscope," was present, and exhibited a very fine No. 3 Powell & Lealand Microscope, and some objectives and accessories also of their make. The stand was universally admired by the members for its splendid finish and the perfect smoothness and regularity of its various movements.

Among other interesting features of the meeting was an exhibition by the President, Mr. Collins, of Prof. H. L. Smith's method of mounting diatoms in hard balsam by heat.

Oneida (N. Y.) Co. Microscopical Society.—January 28th, sixteen gentlemen, interested in microscopical study, met and perfected the organization of a society to be known as the "Oneida Co. Microscopical Society." The following officers were elected: President, Prof. A. H. Chester (Hamilton College); Vice-President, Dr. Theo. Deeche (State Asylum); Secretary, Geo. C. Hodges; Treasurer, H. P. Mallory; Member Ex. Com., Thomas Birt.

We have among us some good workers, some of whom have more than a local reputation, and we trust that it will not be possible to say of us, that "a pent up Utica contracts our powers."

George C. Hodges.

American Microscopical Society.—This society is the oldest incorporated microscopical society in the country, and its collection of materiel and instruments is very large and valuable. It holds its meetings regularly, the officers for 1880 being: President, John B. Rich, M.D.; Secretary, O. G. Mason.

Microscopical Society of Camden, N. J.—At the annual meeting of the Society, held Jan. 6th, 1881, the following were unanimously re-elected officers for the ensuing year:

President, Albert P. Brown, Ph. G.; Secretary, Joseph L. De La Cour; Treasurer, Louis T. Derousse; Managers, H. S. Fortiner, Robt. Patterson, C. Henry Kain; Curator, Prof. E. F. Moody, Ph.D.

The Society has 55 members, 33 active, 20 contributing, 2 corresponding—with its affairs in a flourishing condition, as shown by the respective reports of the officers.

San Francisco Microscopical Society.—The Regular Semi-monthly Meeting of the San Francisco Microscopical Society was held at the rooms of the Society on the evening of December 16th. President Kinne in the chair. The additions to the library consisted of the usual American and foreign scientific publications. The acquisitions to the cabinet were a new diatomaceous earth from Sinker Creek, Owyhee County, Idaho, by Mr. Hanks, which was referred to Wm. Norris for examination; by exchange, from M. A. Booth, Longmeadow, Mass., diatoms and other objects. A paper, by Melville Attwood, was read by Mr. Hanks, who exhibited the specimens described under the microscope, and illustrated the use of Mr. Attwood's reflector in the darkened room. This paper will be found *in extenso* in another column.

Dr. Harkness, who has just returned from Europe and the East, entertained the Society with the result of his observations abroad, and meetings with scientific men. The business of the meeting being soon over, the evening was devoted to interesting discussions on matters scientific and otherwise, with frequent reference to the microscope as objects of interest passed from hand to hand. At a late hour the meeting adjourned.

American Institute of Homœopathy—Bureau of Microscopy.—J. Edwards Smith, M.D., Cleveland, O, Chairman; Conrad Wesselhoeft, M.D., Boston, Mass.; L. B. Couch, M.D., Nyack, N. Y.; Edward Rushmore, M.D., Plainfield, N. J.; C. P. Alling, M.D., Bradford, Pa.

Liverpool Microscopical Society.—The annual meeting was held January 21st, at the Royal Institution, Colquitt Street, Dr. Hicks, the retiring President, in the chair.

On the nomination of the committee, Dr. Hicks and Mr. W. H. Weightman were elected Vice-Presidents; Mr. W. J. Baker and Mr. I. C. Thompson, F.R.M.S., were re-appointed Honorary Treasurer and Honorary Secretary respectively, and the following gentlemen were elected members of the committee: Mr. John Abraham, Dr M'Clelland, Mr. W. Oelrichs, Mr. J. M. Williams, and Mr. John Vicars.

The Rev. H. H. Higgins moved a vote of thanks to the retiring president and officers for their services, remarking that Dr. Hicks had conducted the discussions of the Society during his term of office in a manner which must receive the warm approbation of the members. (Applause.) The motion was seconded by the Rev. W. Banister, and carried unanimously.

Dr. Carter, the President-elect, then delivered his inaugural address. In some preliminary remarks he criticised unfavorably the presumed universal diffusion of a single substance of uniform composition which serves as the physical basis of life. What at most could be meant, unless evidence was to be disregarded, was "protoplasms" (plural)—i. e., the substance special to each kind of organism on the presence of which its vital manifestations might depend, and not a single protoplasm of undeviating composition, which lay at the root of all vital manifestations whatever. He drew attention, then, to the influence exerted by a number of agents on vegetable cell development, and more especially of light and darkness, pointing out simple apparatus by which the action of rays of light of different refrangibilities could be studied; of oxygen, carbonic acid, iodine, and ether. He gave illustrations in growing seedlings of the retarding effect exercised on vegetable cell-development of even very minute quantities of alcohol, one part in 400 often preventing development altogether, while a markedly retarding effect was produced by even one part in 3,200. He also drew attention to the strong inherent vitality of the vegetable embryo of even the more highly organized plants, by the power which it possessed of surviving even severe mutilation, illustrating the fact by a number of actively-growing seedlings reared from seeds which had been cut into various pieces and otherwise injured. A very interesting fact, which seemed to be established, was that light, either alone or in conjunction with moderate warmth, was not sufficient to develop chlorophyle in etiolated plants. Specimens of seedlings in illustration of this proposition, which is contrary to the generally conceived opinion, were exhibited.

The thanks of the meeting were accorded to Dr. Carter for his address, and the usual conversazione followed.

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EXCHANGES.

Wanted, diatomaceous deposits (about a bushel of each kind, by express), for good slides, material, or cash. Geo. B. Scott, Box 4,196, New York.

Wanted, a second-hand microscope with powers of 50 to 350 diameters, price $10 to $35: will give books and chemicals; for list address A. Meyer, Cogan House P. O., Penn., describing microscope and accessories.

First-class slides, palates of marine mollusks and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens: lists exchanged. Rev. J. D. King, Edgarton, Mass.

Will exchange mineral specimens of Idaho for such books, minerals, curiosities, etc., etc., as I desire; Household Microscope wanted; state what you have to exchange, giving particulars. J. F Clough, Junction, Lemhi Co., Idaho.

Selected and well-mounted diatoms, in exchange for other goods, slides, or material, etc. W. H. Tivy, 6th and Olive Sts., St. Louis Mo.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects: none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., care Editor this journal.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co. N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories: a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

A good microscope, costing $136 in Paris, in exchange for a good working spectroscope. Address "Spectroscope," care American Journal Microscopy, 14 Dey Street, N. Y.

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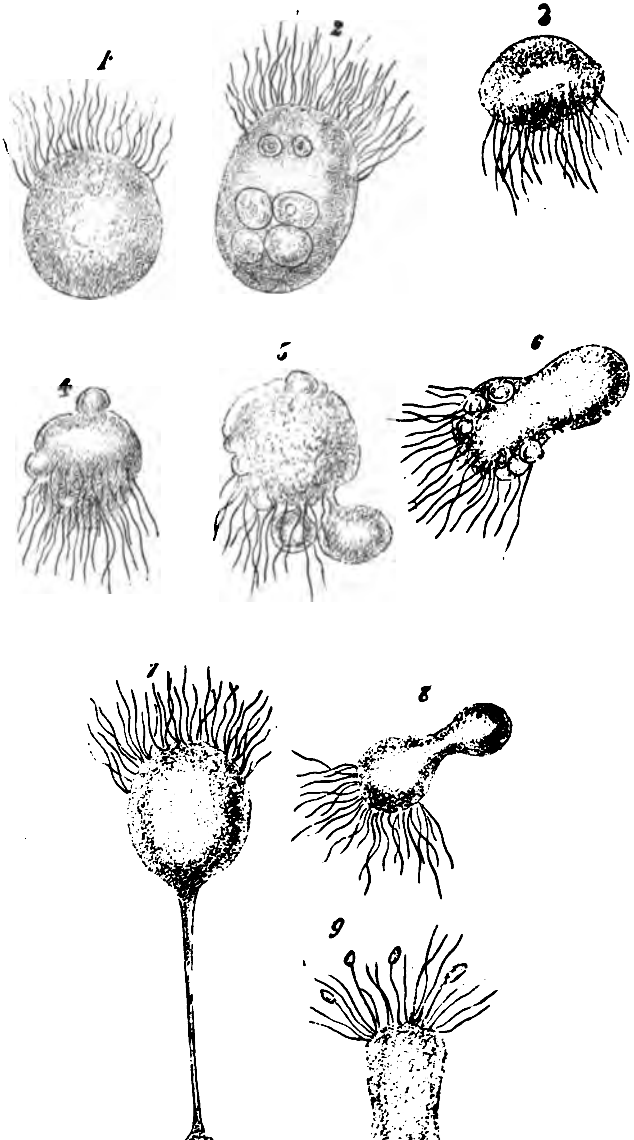
HORSFORD'S ACID PHOSPHATE.

Speaking of this preparation, Dr. C. A. Fernald, of Boston, Mass., says: "I have used Horsford's Acid Phosphate in cases of impaired nerve function, with beneficial results, especially in cases where the system is affected by the toxic action of tobacco."

Boston, Oct. 11, 1886.



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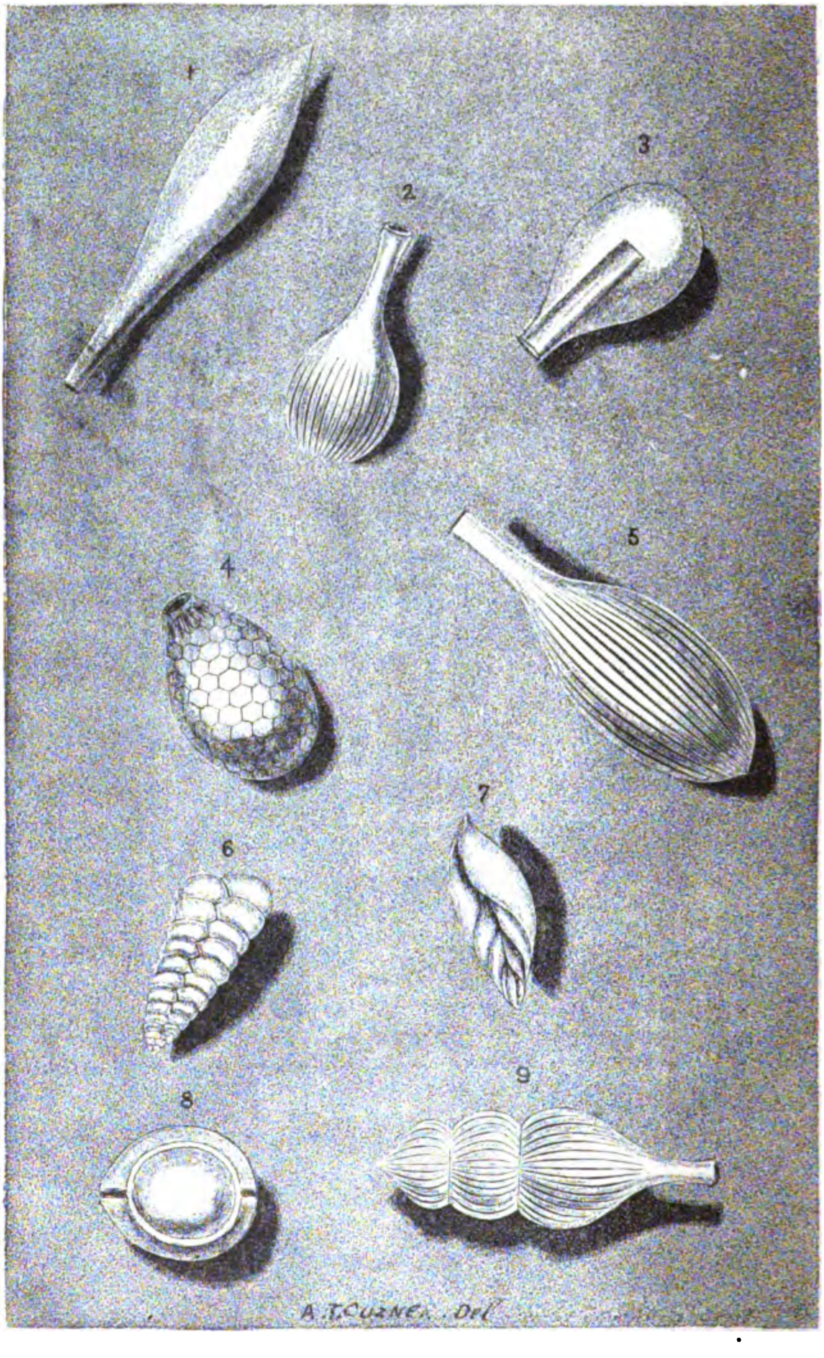

FORAMINIFERA FROM SILT-BEDS NEAR MARCH, ENGLAND.

THE AMERICAN
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AND
POPULAR SCIENCE.

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Microscopic Object Hunting.

BY JAMES GREEN.

If the readers of your valuable journal are willing, I should like for a few moments for them to accompany me (at least in imagination), on a collecting expedition, and the part of the world to which I would invoke them, is to the Fens of Cambridgeshire, in England.

Being provided with the necessary collecting materials, boxes, bags, etc., not forgetting a good strong penknife, we first of all make our way by rail to the town of March, which is situated in the heart of the Fens, and leaving its dismal little station, we commence our walk; about a couple of miles will bring us to the scene of action, and while on this journey I might just say that in various parts of these Fens, there exists considerable banks of sand, or more properly, beds of silt. These beds are covered up with two or more feet of black vegetable mould, and about the only use to which this silt is put is to prevent newly made bricks from adhering one to another before being burned.

Having reached our destination, we find such a bed; no spade will be required to dig into this mass, for already large quantities have been taken away, leaving a beautiful "section," as it were, still standing, like a wall some five or six feet high; and of all places in the world, I suppose this perhaps would appear to my fellow collectors to be the most unlikely to find any material that would interest a microscopist. But I must request my friends not to be too hasty in their judgment; appearances are often deceptive, and perhaps never more so than in this case, for on looking into the wall or section, we can trace thin sinuous lines of a darkish looking material, running in a horizontal direction, not unlike the ripples of the sea. If we now take our bag, etc., and fill them with these wavy lines, we shall be collecting what will prove to be one of the most interesting materials it is possible to procure in the "Fens of England."

Boxes and bags being full, we retrace our steps, and commence to prepare our material.

The first thing necessary is to dry it thoroughly, after which it is thrown into water, when the sand, silt, and other extraneous matter sinks to the bottom, and a lighter substance swarms on the surface; this must be carefully skimmed off, and boiled in caustic potash, after which it should be well washed in pure water, and then placed upon the stages of our microscopes. And, now, what do we see? Hundreds upon hundreds of those beautiful little shells termed Foraminifera; here they are in all their beauty, rivalling some of the larger sea shells in color and shape. Look, for instance, at those exquisite "Lagena," the flask-shaped shells, some like an oil flask, (Fig. 2), others resemble a lemonade bottle (Fig. 1), indeed here are representatives of every description of flask that ever left the potter's hands.

Well, you may say, I thought they lived in the ocean, how came they here? Aye, there comes the rub; so they do, but as you know, these are merely the empty shells, their living inhabitants having long since ceased to exist, and as these empty shells could not travel to the place where they now are, we must conclude that the sea has traveled away from them. However, that may have been accomplished we leave for the Geologist to settle, the fact remains the same.

Then, how they are preserved remains a mystery. They have braved like the flag of Old England for a thousand years the battle and the breeze, such delicate little forms as the Textularia (Fig. 6) as clear as glass, the Polymorphia, (Fig. 7), and others, as perfect as the day they ceased to contain a living creature, and we must bear in mind that they are not formed as are the Diatomaceæ, and Polycystina, of Silex, for these are constructed of carbonate of lime.

I have made sketches of a few of the more interesting forms, but all are worth illustrating, and I think we say with Milton:

> "These are Thy glorious works. Parent of Good!
> Almighty! Thine this universal frame.
> Thus wondrous fair; Thyself how wondrous then!
> Unspeakable! who sitt'st above the heavens,
> To us invisible or dimly seen.
> In these Thy lowest works, yet these declare
> Thy good beyond thought, and power, divine."

March, England.

EXPLANATION OF PLATE.

Fig. 1. Lagena lævis.
Fig. 2. Lemistriata.
Fig. 3. Lagena incurvata.
Fig. 4. Lagena hexagona.
Fig. 5. Striata.
Fig. 6. Textularia.
Fig. 7. Polymorphina.
Fig. 8. Lagena marginata.

Asthmatos Ciliaris.

BY EPHRAIM CUTTER, M.D.

At the present time, Feb. 1st, 1881, probably there are hundreds of thousands of cases in New York city of an epidemic influenza that runs through families and neighborhoods. It is not confined here. In Cleveland, Ohio, it is estimated there have been this season 20,000 cases. Indeed, it runs through the whole country. Dr. George M. Beard thinks it is due to the debilitating influence of protracted severe cold weather, weakening the system so that it becomes an easy prey to colds. Now, colds are ordinarily deemed to be some form of bronchitis, that is, inflammation of the mucus membrane of the bronchial tubes caused by low and variable temperatures of the atmosphere. It is not this form of colds that we propose to write about, as it would not be exactly suited to the columns of a microscopical journal. We desire to call attention to the fact that by the use of the microscope, Dr. James H. Salisbury, of New York and Cleveland, has discovered that one form of contagious cold called coryza or influenza, occurs in connection with a flagellate infusorium called the asthmatos ciliaris, and which was described by him in a publication in Hallier's *Zeitschrift fur Parasitenkunde, Jena*, 1873. See also, *Virginia Medical Monthly*, Richmond, November, 1878, and April, 1879. "Rhizopods a Cause of Disease." *Boston Journal of Chemistry*, November, 1878. (Cutter.) Mr. W. S. Kent, *Popular Science Review*, iv., 1880, pp. 293–309, 2 plates, figures the asthmatos ciliaris among the flagellate infusorial parasites of the human body and gives Dr. Salisbury credit.

It seems timely, then, to call the attention to this subject, of those who are familiar with the use of the microscope, even if they don't happen to be physicians; as such can verify the presence of this parasite, it may be upon the persons of their own families.

It is most easily detected in the early sneezing stage, when the nose runs and the eyes water. The parasites are then located in the anterior nasal passages, on the mucus membrane of the conjunctiva of the eyes, and of the pharynx and larynx. They are more abundantly present in the clear transparent glairy mucus excretion that runs down from the nostrils often to the edge of the upper lip. Under these circumstances the writer has not had any difficulty in obtaining a field full of living forms, by simply transferring a drop of this mucus to a slide, covering and placing it under a positively good objective—1-5th or 1-4th inch—with a good 1 inch ocular. The young individuals are round or globular, with cilia that seem to be withdrawn into the body at will. They generally vibrate to and fro in one direction with rhythmical motions, causing the globular bodies to rock much like the toy Chinese mandarin images. Older individuals are egg-shaped, obovate or mashed ovals. Generally, they do not rock, *not* because their cilia are not in motion, but because the cilia don't move together in one direction at the same time. Each of the many cilia in the old asthmatos ciliaris seems to move independently of the others. As the developed specimens have to do with genesis, so they vary in shape accordingly as they are engaged in the reproductive acts. These have been noticed as follows. 1. Fission. 2. Extrusion of the young from the parent body. 3. By a separation from the parent body as if pulled by force; a long gubernaculum connecting the parent with the new individual. (See *Boston Journal of Chemistry*, as above.) 4. Pullulation. 5. Development on one of the cilia. 6. Congress of the two individuals has repeatedly been noticed, but what influence this union has had on reproduction, has not been traced.

The asthmatos have the power of independent locomotion. Their motions and curious biological manifestations make them most interesting microscopical objects. For example, in the course of 20 minutes I have seen a mature individual turn over thrice. An additional interest is attached to the asthmatos from its pathological relations. It is supposed to be a cause of influenza catarrh, or, as Dr. Salisbury calls it "infusorial catarrh." 1st. Because it is found in the excretions of the respiratory tract. 2nd. Because when the irritation and inflammation is marked by tickling, coughing, sneezing and profuse expectoration, an inhalation of carbolic acid, atomized solution of the benzoate of soda, nascent chloride of ammonium, or the fumes of burning sulphur, will generally allay the symptoms at once, and the asthmatos will be found dead in the subsequent excretions from the respiratory tract. In other words, killing the parasite cures the disease.

For fuller details, see the papers quoted. Still, it may be remarked that the asthmatos rapidly penetrates the deepest portions of the air passages, and becomes more difficult of detection as time goes on. It will penetrate into the frontal sinuses, the lachrymal ducts, into the eyes, and into the smallest ramifications of the bronchial tubes. It has been found in spasmodic croup and in connection with bronchitis, pneumonitis and pleurisy.

In these complications it may be formidable, and doubtless deaths have been caused by its influence, added to such complications.

But the affections caused by its presence are peculiar in that the infusorial catarrh occurs at all seasons of the year, and attacks the same individual repeatedly, especially when that individual is the person who studies the subject from the excretions. Often the complaint will get well of itself; still, I have seen cases that resisted all the treatment that could be brought to bear.

Diagnosis—*The microscope is indispensable to a correct diagnosis.*

Here its value as an instrument of precision is most clearly shown. The mucus corpuscles of the respiratory tract must be recognised and distinguished from the asthmatos, so also must the ciliated epithelium.

Some have pronounced the asthmatos to be merely degenerations of the ciliated epithelium, but such, as yet, have failed to reconcile their opinion with the fact that the asthmatos is found on the mucus membrane of the eyeball, where no ciliated epithelium was ever reported to be found by any histologist. That Dr. G. B. Harriman, of Boston, my associate, once found the asthmatos in the atmosphere of an infected district. That Prof. P. F. Reinsch, of Erlangen, declares them to be entirely distinct from ciliated epithelium, he having for years studied his own nasal excretions, recognising the ciliated epithelium, but never the asthmatos, until he contracted them from studying the writer's own nasal excretions while he was suffering from the infusorial catarrh. We respect those who dissent, but before we relinquish opinions based on the careful study of thousands of cases, extending over a period of more than ten years, for the opinion of those who confess that they have seen but a few solitary instances of the so-called complaint, the latter must explain the life phases we have indicated, and, also, how it is that they can be studied under a watch glass entirely away from their host. We have not heard that ciliated epithelial cells can be so cultivated.

The subject is important, as it involves all classes of society, and the treatment of this infusorial catarrh by parasiticides, the identification of which we owe to the microscope, is a tremendous advance in therapeutics.

As to the classification, the protozoa are still in some confusion. Dujardin calls rhizopods infusoria. Claparede and Lachman leave the question of the classification and definition of the flagellate infusoria open, 1868. Leukardt considered them to be algæ. Griffith and Henfrey place the rhizopods in a class by themselves, while Prof. Reinsch, the algologist, says the asthmatos is truly a rhizopod. Dr. Leidy says it is not a rhizopod. Such honest differences of opinion entertained by distinguished scientific men arise as to other things—yeast, for example. Let us respect them. Meantime, such a respect should not stand in the way of a thorough study and vigorous parasiticide treatment of the infusorial cattarrh wherever it may be found infesting the human subject. Yeast is used domestically, though savans differ as to its biology and position.

If we succeed in promoting the diffusion of the knowledge of this parasite and its easy cure by its destruction, the object of this paper will be accomplished.

EXPLANATION OF PLATE.

Illustrations drawn from life, from freshly procured specimens, by Dr. A. I. Cuzner and Mr. B. H. Day, both of New York.

Fig. 1. Young rocking Asthmatos ciliaris.
Fig. 2. Mature individual with included young.
Fig. 3. Underview of a specimen.
Fig. 4. Adult, pullulating.
Fig. 5. Adult with the budding process more definitely shown
Fig. 6. Adult individual commencing a fission with young located about the origin of the cilia.
Fig. 7. Genesis by the gubernacular method.
Fig. 8. Adult with constriction beginning but not complete.
Fig. 9. New individual with cilia developing into young by budding.

246 West 44th Street, New York, N. Y.

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How I Make Wax Cells.

BY F. L. BARDEEN, M.D.

IN looking over the issues of your Journal for 1880, I notice many letters from different correspondents in reference to the wax cell, some condemning and some praising it. Among the former, I notice Prof. Smith, who I believe is its originator. He laments ever having brought it into existence, and is willing to transfer all right, title, and whatever of glory attaches thereto to any one who wishes to take it off his hands.

In view of its early brilliant promise, and present measure of success, would it not be well to try still farther to rear it into full maturity? Thinking so, I am constrained to add my mite towards this end, and if you think the wax cell is not "done to death," please hand in my testimony in its favor.

I now have about two dozen cells over a year old which are as good as when put up—not a flaw or sign whatever of moisture or condensation on the cover—no cracking, or cleaving, from the slide. I have also sent at least three times as many to correspondents, mounted in the same way and at the same time, and as yet I have to hear of any going astray. Right here I would request anyone to whom I have sent opaque slides within a year, of my own mounting, and who may see this article, to let me know by postal how well they keep.

I do not know that there is anything essentially new in my method or anything that others have not done; still one or two points I have not seen mentioned.

1st. I try to make the cell perfectly dry. This I do by *melting the wax as I make the cell*, also by drying the object and cover-glass and mounting as quickly as possible.

2nd. I hermetically seal the cell.

Concerning the first, I melt the wax as it is put on the slide, and also again as I shape it with the glass rod. I consider the melting as a very essential step in the process, as will be seen by the "sputtering" when melted and when remelted by the glass rod. The sputtering indicates moisture. The details are as follows.

For deep cells I use brass rings to suit 5-8th inch covers. For shallow cells one or two layers of tin foil rings cut out with gun punches. First cut from thin wax sheets two or three discs, and place on the slide—on the discs place the ring, (heated). Heat the slide till the wax melts. Some of it will run under the ring and form a wall outside the ring. Press the ring to the slide. Before it solidifies put it on a turn-table and centre it. This will necessitate quick work on the non-self-centering table. It is best to prepare a number of slides thus far before the next step is taken.

The cell is now half or two-thirds full, and level. Next take a glass rod 6 or 8 inches long and ⅜ inch in diameter, round one end off in an alcohol flame, heat it hot enough to melt wax, and with the slide on the turn-table make a depression all around the cell next the ring. This remelting and stirring as the table revolves) has the effect to still further displace any remaining air. Keep the table revolving until the rod is cold and the wax solid. The cell has now a raised ridge of wax on and at the inner edge of the ring, and a raised central part on which the object is to be mounted. (Fig. 1.)

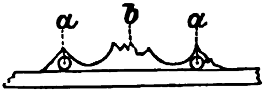

Fig. 1. Vertical section of cell. *a a* cross section of ring; *b*, central portion.

Now with a turning tool (Fig. 2,) made on the end of a small thin flat file or a similar piece of metal, turn the cell down as in Fig. 3. If the form of the object to be mounted permits, it can be fastened in place by simply touching the wax with the point of a hot wire. If the object is like globular sand or polycystina, liable to roll about, a depression can be turned in the central part with slight containing walls. (Fig 4, *a. b. c.*) If desired the central portion can be made as high as the outside, so that the cover will touch it when in place, (*c*). If more room is needed, the whole cell may be made as at (*d*).

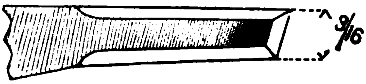

Fig. 2. Beveled turning tool, actual width at point 3-16 inch.

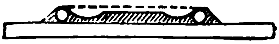

Fig. 3. Central portion leveled off, also part over ring for cover.

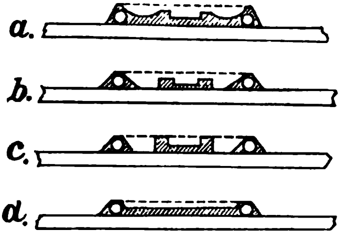

Fig. 4.

I put the cover on as follows: Heat it enough to drive off all moisture, but not hot enough to melt the wax—lay it on the cell—retain it with a spring clip of *slight* pressure and then hold it over the top of a lighted kerosene lamp just an instant. The pressure of the clip forces the cover into the melted wax and the cell is hermetically sealed.

Trim off on the turn-table any surplus wax on the cover or outside of the cell, and clean with a bit of cloth folded over the end of a small wedged-shaped piece of wood and dipped in alcohol.

Coat the cells and outer edge of the covers with Walmsley's zinc cement *first*, and put on black or colored rings *after* it is dry. Cells that "run in"—at least some of them—have had the Brunswick black put on first. This is wrong, for the turpentine is very penetrating, and should not be used until the zinc cement is quite dry.

This method gives all the beauty and mechanical perfection of lathe work, and if due precaution is had in regard to the essential steps, will give, I believe, the best cell for opaque mounting.

Rochester, N. Y.

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Growing-Cells.

BY A. C. STOKES, M.D.

IN the issue of the AMERICAN JOURNAL OF MICROSCOPY for June last, the editor kindly published a letter in which the present writer suggested that a paper on "growing cells" might be useful to those non-professional microscopists who love "to pry into things," but whose pockets are always too short for the dealers' golden picks and crow-bars, and in which a request was also made to its readers to send descriptions of their original microscopical life-preservers, or of their lucky "finds" in any publication not generally accessible to the journals' subscribers. The replies have not been numerous, but with their help a collection has been made, in time for the reopening of the Spring campaign among the infusoria and the algæ.

In selecting the following series, the chief object, aside from their usefulness, has been to present only those which the student could make for himself with the expenditure of nothing but a little time and labor; and the workers who may find them of any assistance should give thanks, as the writer does, to Prof. Phin, the editor, and to Mr. C. E. Hanaman, of Troy, N. Y., without whose aid the article could not have been prepared.

The simple arrangement shown in Fig. 1, is a modification of a cell originally devised by N. E. Green, a writer in *Science Gossip* for 1867. It was there styled a bath, and had for its object the preservation of *Melicerta ringens*, and its study with high powers. The cut represents a thin square attached to a 3 x 1 slip, the dotted outlines being a strip of paper, or card-board, upon whose thickness depends the depth of the cell. The original "bath," however, was formed of two plates of thin glass, one about 2 inches by 1¼, the other ¼ inch narrower, the extra size of the first being required as a ledge, on which to drop the water, or rest the object previously to inserting it between the glasses.

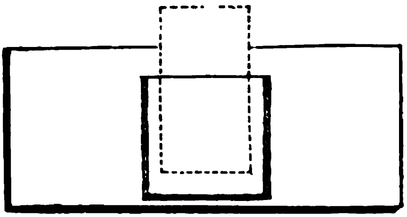


Fig. 1.

In Fig. 2 is shown a contrivance almost as uncomplicated as the preceding, taken from Beale's "How to Work with the Microscope," and used by that microscopist with much success. A small piece of glass tube is fixed to an ordinary slip to serve as a reservoir for the supply of the water. It is covered with a piece of thin glass, a small opening left at one side being sufficiently large to allow a fine thread of silk or cotton

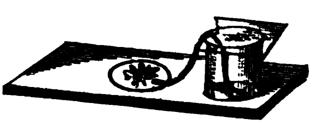


Fig. 2.

to conduct the water from the reservoir to the specimen placed in the centre of the slide.

Fig. 3 represents in section a contrivance so uncomplicated and so really useful, that it might well be named the "simple cell." It consists of a ring of cement or of metal attached to the glass slip, and carrying a thin cover, on the under side of which is placed a drop of water containing the object. If it is desired to make the surfaces of the liquid parallel, a second and smaller cover may be added, which will adhere to the upper by capillary attraction. The great advantage lies in the abundance of air, while at the same time the water is prevented from drying up.

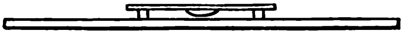


Fig. 3.

Fig. 4 is a very efficient growing-cell, made upon the "old principle of the bird fountain," by Prof. H. L. Smith, and described by him in the *Am. Journal of Science and Arts*, Sept., 1865. He says:—"The whole slide as I have constructed it, is a trifle more than ⅛th of an inch in thickness. It consists of two rectangular glass plates 3 x 2 inches, and about 1-25th of an inch thick, separated by strips of the same thickness cemented to the interior opposed faces, as shown in the figure. This closed cell, ultimately destined to be filled with water, is not of such thickness as to prevent the use of the achromatic condenser, a very important requisite. The upper plate has a small hole, A, drilled through it, and one corner removed, as at B. A small strip of glass cemented at C serves to prevent the thin glass cover over the object from sliding. Another strip is cemented on the lower side of the cell at D, but not extending as far as the removed part at B. The object of this is to prevent the water in the cell from being removed by capillary attraction, in case the slide in the neighborhood of B should be a little wetted. This strip is not, however, absolutely necessary. To use the slide, fill the space between the two plates with clean water, introduced at B, by means of a pipette, and also place a drop on A, to remove the air. The object being put on the top of the slide and wetted, is now to be covered with a large square of thin glass, E, at the same time covering the hole, A. The slide can now be placed upright, or in any position, and no water can escape. . . . . . . As the water evaporates from under the cover, more is supplied through the hole, A. and from time to time an air bubble enters at B; thus a constant circulation is maintained. A cell of the size named will need replenishing only about once in three days, and this is readily effected without disturbing the object, I have been enabled," Prof. Smith continues, "to make observations by means of this slide, which it would have been very difficult, if not impossible, to have made without it."

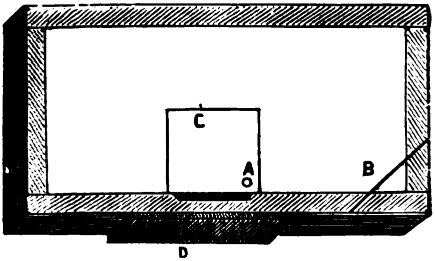


Fig. 4.

Mr. Jno. H. Martin, Micro. Assay Laboratory, Maidstone, England, describes in the *American Naturalist*, vol. vii, the growing cell represented by Fig. 5. He says:—"Cut two pieces of moderately thick crown glass, one 3 inches by 1¼ inches, the other 1¾ inches by 1¼ inches, cement these together with Canada balsam; when dry, fix with

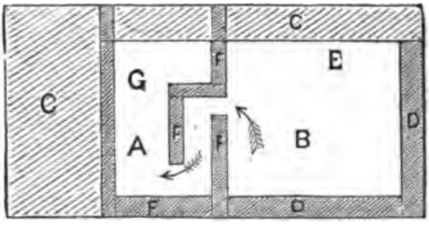


Fig. 5.

the same cement, two slips of glass of the same thickness to the other end of the slide so as to form the sides of the reservoir, D D; also fix with gold-size slips of thin glass, so as to form the sides of the growing cell, F F F F; when quite dry, cement a piece of thin glass 2¼ inches by 1¼ inches over all. . . . . . When used, the reservoir, B, is filled with fresh water until it runs into the growing cell, A, and both are at the same level. If made of these dimensions, the water in the reservoir will continue to supply fresh water to the growing cell for at least three days without being refilled. C, in the figure, is the glass slip; A, the growing cell; E, thin cover; B, the reservoir; G, growing object.

Fig. 6 from Prof. Phin's "How to Use the Microscope," is easily made by cementing a small bottle to one end of a slip with a concave centre, as shown in the cut. "The bottle is filled with water and corked, the upper side of the cork having two notches cut in it, one for the entrance of air and the other for the passage of a loose cotton thread. The object is placed in the concavity, covered with a piece of thin glass, and the end of the thread is carried under the cover by means of a small notch cut in the slide with a file. The bottle must be filled with very pure water, otherwise the salts, etc., contained in it, become concentrated under the thin cover, owing to the evaporation, and destroy the object."

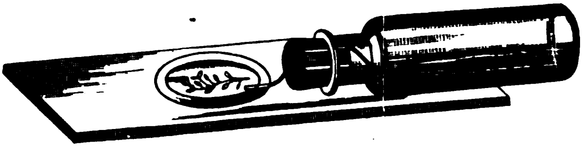


Fig. 6.

Of the above, Mr. A. B. Porter, of Indianapolis, Ind., sends a modification, which he finds very satisfactory. Having no concave slide, he cut a ring of sheet-wax (tin-foil, thick paper or card-board soaked in asphalt will do nearly as well), and attached it to the centre of a slip. He then opened two little channels through the wax into the cell, one for the entrance of the thread, the other to supply the air necessary to the growth of the objects. The cover will be held on by capillary attraction, but my correspondent found it desirable to fasten it, after the cell is filled, by melting the wax around its edge with a touch of a hot wire.

Beale, in his work already referred to, describes what he calls a growing stage devised by Dr. John Barker, of Dublin, and characterizes it as "very convenient, efficient and cheap," with the additional "advantage of allowing the use of the ordinary glass slide." "Any one can make this growing stage for himself with very little trouble. A segment of a largish circle is cut in a plate of stout glass to form the stage. To one end of this is attached, by means of marine glue, a small flat glass bottle, in which two little holes have been drilled. When water is put into the bottle it is conveyed from one of these holes to the thin glass cover under which the object is

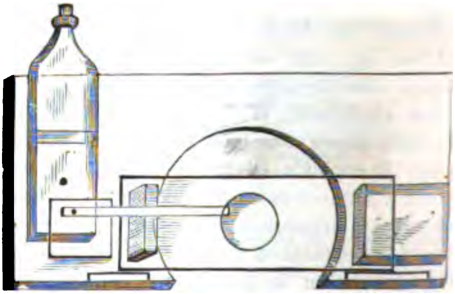


Fig. 7.

to be kept moist, by means of a narrow strip of talc which acts as a conductor." This arrangement is represented by Fig. 7. The glass block, to which one end of the strip of talc is cemented has a hole drilled through it, and must be so placed that this opening shall be continuous with the lower one in the bottle. The stage can be put on the microscope with the slide in position, or the latter can be slipped out by raising with a needle the free end of the talc. When the object is not under observation, the apparatus should be kept on a support at an angle of about 50°. Mr. Hanaman suggests that this growing cell might be simplified by making the plate, blocks and ledges of wood.

In the *Monthly Microscopical Journal* for March, 1869, Mr. J. C. Muller, describes a simple form, made by piercing an ordinary slide with a minute hole at about 3-10ths in., from the centre. When an object is placed upon it immersed in water, the thin cover is so arranged as to include this opening, and when not on the stage of the microscope, the object is kept moist by putting the slide in a vessel of water and so arranging it that the hole shall always be beneath the surface. The cell is shown in Fig. 8, and in Fig. 9 a section of the same when in the water-bath. A cell of any depth may be made by cementing a glass ring to the slide.

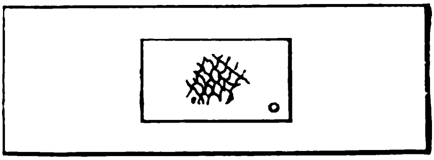


Fig. 8.

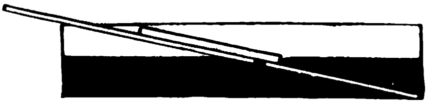


Fig. 9.

In the same journal for January, 1870, Dr. R. L. Maddox gives a description of a growing cell which he had devised for the "Cultivation, etc, of Microscopic Fungi," as follows: A piece of tin-foil of the stoutness of ordinary note-paper, was cut in squares one inch on the side; a portion was then removed from the square by cutting it from one side almost to the opposite, then at right angles, and again at right angles, thus leaving a strip shaped like the letter U with a flat base, and limbs of equal length and width; from the piece removed, a narrow slip was cut from three sides, and a portion taken out as in the first piece, thus forming a smaller letter u. The larger was cemented to a slide, and the smaller similarly fixed within it, the limbs being turned in opposite directions as seen in Fig. 10, forming a central space for the material under examination, and a narrow channel each side for the admission of air. The square cover-glass, of a size sufficient to cover the outer U of tin-foil, with the spores upon its under surface in a drop of cultivating solution, is inverted on the cell and sealed, except at the points corresponding to the open ends of the narrow passages. The cultivating medium should *not touch* the inner edges of the the tin-foil at any part. The slide should be charged with spores by placing a minute drop of an hygrometric cultivating fluid on the cover and transferring to it by means of a needle-point the spores to be studied. When prepared, the slide was placed in a moist chamber consisting of a small, porous battery-cell previously thoroughly cleaned, which, having been wet with freshly boiled water, was set in a basin of the same water to the depth of half an inch, the basin being covered by a plate of clean glass. The moisture found on the slide when removed from the chamber for examination, may be made to quickly disappear by resting it on end in a clean tumbler (warm if necessary), and covered with a bell-glass.

The same writer in another number of the *Monthly Microscopical Journal*, describes a modification of the above for the propagation of spores collected from the atmosphere. Wishing a more simple method, he says, of forming the air-space than with the tinfoil arrangement previously described, a preparation of mastic, wax, chloroform, etc., was made, which, by aid of a small brush, could be drawn across the surface of a slightly warmed slide, so as to form a square the size of the thin cover, but with one side prolonged to the edge of the slide, and the other brought nearly to meet it, and then turned down also to the edge, so as to leave a small channel for the entrance of air. The cover was very gently pressed along the edge, and so remained fixed on the cement. See Fig. 11.

To form a simple damp cultivating chamber to contain a number of slides at once, a large new ordinary writing-slate with a well-made frame, had the latter deepened on the surface by an extra frame about 1-6th of an inch thick, and furnished with a couple of cleats at two ends, and with a stop or check on a third side. After well cleaning the slate, a leaf of thick white blotting-paper was laid on the surface, and on this a sheet of clean pierced zinc the size of the slate tablet. The blotting-paper was dampened with distilled water, the piece of pierced zinc placed on it, and a sheet of clean flat glass pushed along the grooves in the cleats at the two ends up to the stop on the opposite side of the frame, so as to form a close cover to the thin flat slate-box.

In the issue (for March, 1876) of the publication so often referred to, a notice is given of a "Growing Cell Adapted for Supplying Moist Air," which had been described by Drs. Lewis and Cunningham, in their work on the fungus disease of India. It consists of an ordinary 3 x 1 inch, slide with a ring of beeswax (softened with oil), pressed on its surface. Intervening between the wax and the slide clamped by it, is a narrow slip of blotting-paper, and above the wax the thin cover is placed with a drop of fluid containing the spores. The preparation is thus hermetically sealed except at the spot where the paper is inserted, the latter serving as an excellent channel for the air and moisture necessary to the perfect growth of the object under cultivation. There is no danger of dust being introduced, and the gases which the nutritive fluid may generate can readily escape.

To the *Journal of the Quekett Microscopical Club*, for February, 1880, Mr. J. E. Ingpen, F.R.M.S., communicated a description of a growing cell, constructed by M. Julien Deby, Vice-President of the Belgian Microscopical Society. It consists of a 3 x 1 inch slip, having a glass ring with ground edges cemented to it to form a cell. A small hole is bored through the slip inside and near the edge of the cell. The objects are placed with a very minute drop of water on a thin cover, which is then inverted and attached to the top of the cell by a little lard. The slip is then laid upon another of the same size, but not perforated, and a couple of india-rubber bands are passed over the ends. One end of this arrangement is then placed in a little water, which, by capillary action, will occupy the space between the two slips, and by evaporation will rise into the cell and prevent the drying up of the minute drop on the cover. By this contrivance a drop of water no larger than a pin's head can be kept of nearly the same size for weeks together, and the development of bacteria, or other minute organisms, retained constantly under observation.

M. Deby has recently described what he considers a simplified arrangement of the above:—Take a slip and make in its centre a circular opening ¼ inch in diameter, lay it upon a slide not perforated, and bind the two together by rubber rings. Grease the upper slip for a short distance around the opening, arrange the object on a thin cover, adding to it another cover ¼ inch in diameter, which will adhere by capillary attraction, and invert the whole over the central aperture. When not under observation place in a shallow vessel of water, as in the original.

A simple form of "Culture Cell" is described in the *American Monthly Microscopical Journal*, for August, 1880, by Dr. Geo. M. Sternberg, as a member of the Havana Commission for the Investigation of Yellow Fever. It is made by drilling an opening about ¼th inch in diameter through the centre of a slip. A very thin circle of

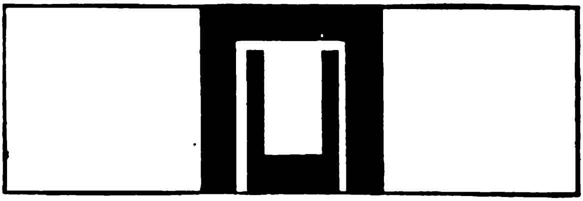


Fig. 10.

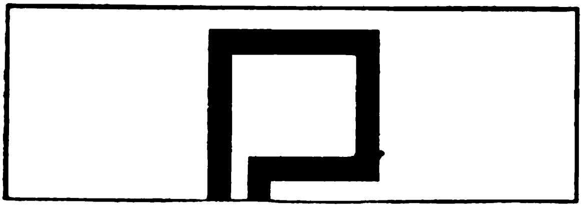


Fig 11

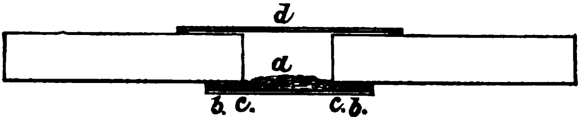


Fig. 12.

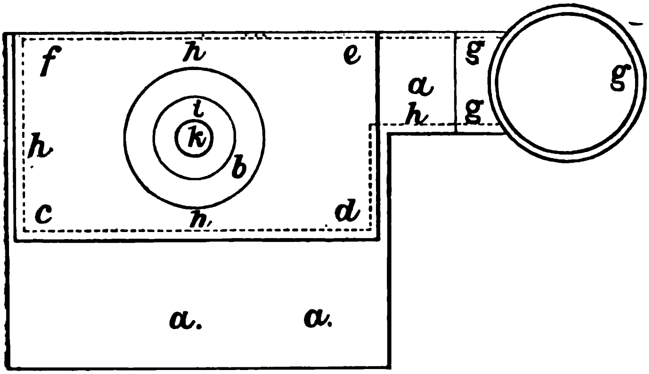


Fig. 13.

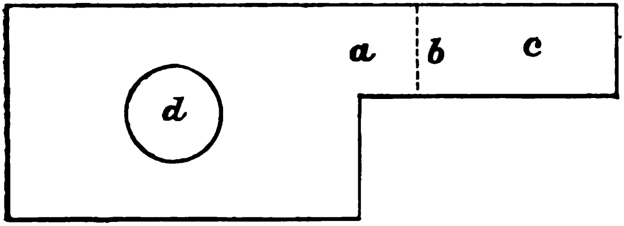


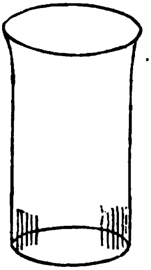
Fig. 15.

cement ¼ inch in diameter, is turned around this central hole on one side of the slip and a thin cover attached to it by gentle pressure. When the cement is thoroughly dry, the cell is ready to receive the drop of blood or other fluid to be observed. This is placed in the bottom of the cell, *a*, in Fig. 12, which shows the slide in section, and flows by capillary attraction into the space between the thin cover and the slide until it extends to the circle of cement. Thus there is a thin stratum of fluid between the points *b* and *c*, which may readily be examined by inverting the slide and bringing the objective to any point between the central air-chamber and the cement circle. Finally, the cell is closed by fastening a large thin glass circle, *d*, to the opposite surface.

The apparatus next to be described, is the celebrated one used in the famous researches of Mr. Dallinger and Dr. Drysdale, in their Life-History of the Monads. It consists of a plain glass plate, *a*, *a*, Fig. 13, so fitted as to slip on the microscope in place of the ordinary sliding stage. The thickness of this plate, although only 1-10th inch, is too great to be used with the condenser and high powers; a circular aperture, *b*, is cut through it, and a thin piece of good glass, *c*, *d*, *e*, *f*, is fixed over it with Canada balsam. At the end of the arm, *a*, which extends some distance beyond the stage to the left of the observer, a brass socket, *g*, *g*, *g*, with a ring attached, is fastened with marine glue. The object of the ring is to hold a glass vessel Fig. 14, about 2 inches deep. It simply drops in, and the top being slightly larger than the ring, it is prevented from slipping through. The stage being in position on the microscope, and the reservoir in the ring, a piece of thick bibulous paper is cut to the shape drawn in Fig. 15, the part *a* being long enough to reach to the end of the glass stage and to bend over at *b*, leaving the portion *c* in the vessel. Mr. Dallinger, in his more recent investigations, uses a piece of linen instead of the blotting-paper to convey the moisture to the chamber. Its position is indicated in Fig. 13 by the dotted lines *h*, *h*, *h*. Before it is placed upon the stage, a circular opening, *d*, Fig. 15, is cut out, which must be larger in diameter than the thin glass cover intended to be used. The inventors, therefore, preferred small covers; those ¼th inch in diameter, the aperture in the paper being 11-16ths, worked well. The vessel with the flap of blotting-paper in it is filled with water, and a drop is placed on various parts of the paper which is soon thoroughly and evenly wet. A drop of the fluid to be examined must be placed at *k*, Fig. 13, and the cover glass, *i*, laid on.

To form a moist chamber over the preparation a piece of glass tubing about 1¼ inches in diameter is cut to ¾ths inch in length. Over one end of this a piece of thin sheet-caoutchouc is firmly stretched, and a small hole is made in its centre. This part of the apparatus is shown in Fig. 16, *a* being the tube, *b* the elastic film, securely tied on by means of a groove in the glass at *d*, *c* an aperture, and *e* the lower edge which should be carefully ground. Thus prepared, the tube is placed on the blotting-paper so that the opening *c*, is above the centre of the cover-glass.

Fig. 14.



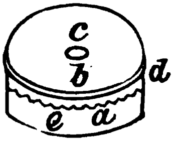


Fig. 16.

The objective is carefully racked down *through this small hole* and adjusted to focus.

The caoutchouc should be thin enough to afford no impediment to the action of the fine adjustment, and by its elasticity at the aperture it should clasp the objective while the latter, by its gentle pressure, forces the under surface of the chamber upon the blotting-paper so that little or no air is admitted. If the lower edge of the tube be carefully ground, it will allow the plate, damp paper and all, to move under it when the milled heads for working the mechanical stage are in action. Fig. 17 represents a perpendicular section of the apparatus when in working order. It will be found in practice that this life-slide may be in use for a long time without any change in the arrangement except the alteration of the fine adjustment. The microscope, however, must be placed in a vertical position, but no inconvenience will arise from this if the instrument be placed on a sufficiently low support.

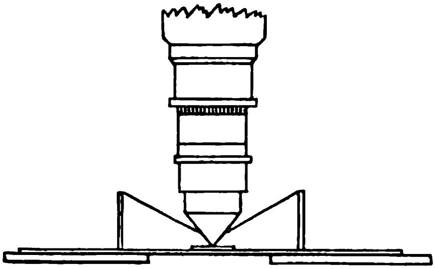


Fig. 17.

Mr. W. H. Wight, of Baltimore, in the *American Monthly Microscopical Journal* for February, describes and recommends a growing slide as follows: "A small hole is drilled near the margin of a concave slide or near the centre of a plane one. Through this hole is inserted a strand of cotton-thread with one end in contact with the glass cover, the other immersed in a vessel containing the water, which, in Mr. Wight's case was a soap-dish. Thus there is a perfect circulation, limited only by the large supply of water. The advantages of the plan are that it is inexpensive, and the glass slip can be used as an ordinary slide, besides the opportunity one always has of finding anything on the slide worth future study, and of immediately converting it into a growing-slide, thus avoiding the loss of rare objects which it is sometimes desirable to preserve for further study."

Having had Mr. Wight's slide in constant use for a month, I find it worthy of every commendation. A hole not more than 1-32 inch in diameter, drilled by the sharpened shank of an old cataract-needle, and a piece of Clark's No. 70 sewing-cotton doubled and loosely twisted, have kept a deep cell abundantly supplied with water for many days, a channel being cut in the ring for the thread, and another opposite to facilitate evaporation.

In the same journal Professor Strassburger's moist chamber is described as follows: It consists of an ordinary slide, upon which is placed a ring of pasteboard moistened with water. The object which is to be observed and kept alive is placed in a drop of water on a cover-glass and inverted over the paste-board chamber, the cover being made to adhere to the cell by pressure. The evaporation of the water is greatly retarded, if not entirely prevented, so that in this simple manner Prof. Strassburger has kept *Spirogyra* in conjugation alive for several days. By moistening the paste-board from time to time the cover will remain attached indefinitely.

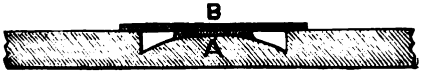


Fig. 18.

Fig. 18 shows Weber's life-slide in section, a useful accessory, but one which can hardly be made at home. Its construction and mode of action have been previously described in this journal, and will be readily understood from the engraving.

By way of conclusion it may be well, as suggested by my correspondent, Mr. C. E. Hanaman, who has given such efficient aid toward this compilation, to say to those not already familiar with the fact, that a hole can be easily made through glass by means of a drill or a rat-tail file, the point of which has been ground to a triangular shape, provided the tool is kept constantly wet with turpentine. If a file be used, the operator must remember to always turn it from right to left; if turned in the opposite direction, it will lock in the glass and break it.

Trenton, N. J.

Mounting Marine Algæ.

BY REV. J. D. KING.

> "A few marine algæ mounted in balsam obtained our sympathetic commiseration, that those beautiful "weeds of the sea" should be so viciously treated. No intelligent traces were left of the living things. May our eyes never be asked to witness such relics again. Put all marine algæ in Goadby's solution, and many will be preserved unchanged."—*Report of Academy of Natural Sciences, Philadelphia, Nov.* 1, 1880.

THERE is a good deal of truth in the paragraph which stands at the head of this article, but taken as a whole it is quite too sweeping. Many of the Ptilotas, Polysiphonias, and others of similar character, and even the delicate Callithamnions, make most beautiful slides, and they eventually do retain "intelligent traces of of the living things, especially in *color*, which balsam preserves as nothing else does. Most forms, indeed, shrink more or less in preparing to mount in balsam, but in connection with fluid mounts, they are excellent for study, especially if in fruit, and much better than herbarium mountings can be.

Growing on many of the larger algæ are parasitical forms of confervæ, brilliantly colored, and these are perfectly preserved in balsam.

Marine algæ are often richly covered with diatoms, which, besides being beautiful objects *in situ*, especially when seen with paraboloid, are studied to great advantage in this position.

Now, supposing we have a delicate filamentous alga, covered with diatoms, that we wish to preserve as perfectly as possible, we will first select the cleanest frondlet that one can find, and with a delicate brush remove all foreign matters possible without disturbing too many of the diatoms, rinse thoroughly in salt water, and at the last moment take up the alga from fresh water on a glass cover, drain as quickly as possible by placing the edge of the cover in contact with blotting paper, and dry in air. Some of the algæ fade rapidly in fresh water, but if the work is done rapidly they will suffer but little, while if taken up from sea water, crystals of salt will appear in the slide. When thoroughly dry, soak in chloroform, cover and all, twenty-four hours, or till the air is absorbed from the preparation, thence transfer to balsam, made quite thin with chloroform, allowing it to remain a short time, and finally mount in benzole balsam. If preferred, a perfectly clean film of mica, cut the size of the cover, with a punch, may be used instead of the glass cover, treated in the same way, and mounted with the alga.

A fluid or gelatinous medium for the perfect preservation of algæ is very much wanted. Goadby's and Ralf's fluids are both excellent in many respects, and so are a dozen others, but I have yet to see a brilliant alga placed in any of them without loosing its characteristic brilliancy. The best medium for preserving color, either of marine or fresh water algæ, so far as I have tried it, is a preparation suggested by Dr. Munson, of Otisco, N. Y., chloral hydrate, 15 grains; water, 2 ounces. The tendency of this fluid is to make objects preserved in it more transparent, but I have slides of green algæ mounted a year ago, which yet retain the brilliancy of living colors, and appear in striking and favorable contrast with those mounted in other media. It needs a further trial before pronouncing safely upon its merits, but I believe it to be worthy the attention of algologists.

—Glue, if kept for some time after being dissolved in water, decomposes and loses much of its strength. Those who use glue occasionally should melt no more than they need at once. Glue is also greatly weakened by being burned or too highly heated.

On the Use of the V-Shaped Diaphragm.

Read before the Memphis Microscopical Society. Jan. 21st. 1875.

BY J. EDWARDS SMITH.

THE interest which this simple contrivance has excited, leads us to republish Prof. Smith's original paper on the subject which his kindness enables us to reproduce. Prof. Smith writes us that "this experience of 1875 is also the experience of 1881. In the interim a large variety of sub-stage illuminators—including the Wenham reflex, the Woodward prism, the traverse lens, and the like, have been from time to time added to the accessory-box, and, doubtless, are at times useful, but for a *clean square* resolution of severe tests by oblique light, I still prefer the ferrotype plate." In calling this device the V-shaped diaphragm, an erroneous idea is conveyed to the mind of those who have not seen it or read a description of it. It is rather a >-shaped diaphragm. The term "oblique" diaphragm which has been sometimes applied to it, is, however, altogether a better name.—ED. AM. JOURNAL MICROSCOPY.]

Some weeks since when engaged in testing the extreme apertures of several objectives (including a 1-6th and 1-10th immersion, Tolles' new formula), I used, for the purpose of cutting off the central ray, a simple piece of japanned iron plate—the ordinary ferrotype plate used by photographers.

The usual diaphragm-box and revolving plates were removed, leaving the entire underside of the stage entirely unobstructed; the piece of ferrotype plate was fastened by a screw near its edge farthest removed from the illuminating lamp, so as to entirely close the "well-hole" of stage. Now, by bending the ferrotype plate it was easy to convert it into a <-shaped diaphragm, with its open side adjacent to the mirror—and the included angle formed by under side of stage and the ferrotype plate depended entirely on the disposition (bending) of the plate.

While using this rude and simple apparatus, with an objective of 170°, the ferrotype plate making an angle of 20° with underside of stage, the illumination being furnished by a German Student lamp, I was surprised to find that I got strong views of transverse striæ on No. 18 of the Möller probe platte, the same shell having utterly defeated the objective named on a previous occasion. Since, I have made numberless experiments, using a variety of wide-angled objectives, and find the < diaphragm of singular advantage when resolving severe tests.

As to the percentage gained by the use of the diaphragm, I hardly know—and this will probably vary with the objective used. I detail a single experiment, and leave others to form their own conclusions.

With the Tolles' 4-system (1-10th immersion) German Student lamp, and using aperture, say 160° *without* diaphragm, I usually see A. pellucida on Möller platte (No. 20), exhibiting transverse striæ in *patches*, and strongest near the end of valve; turning the diaphragm into position, and so as to include angle of 20° with under surface of stage, and little, if any, change made in the illumination, I now easily get strong striæ of transverse lines, and evenly distributed from end to end of the shell. Similar results obtain when viewing Nos. 18 and 19 on same plate. This much for work with oblique light.

Another fact is perhaps of still greater importance. The diaphragm may be bent so as to include any angle, say from 5° to 50° with lower surface of stage; we will assume, say an angle of 45°. Now by a proper disposition of the radial arm carrying the mirror, arranging so that the diaphragm "splits" the illuminating beam, *i.e.*: one-half entering the wedge-shaped aperture, while the other half is excluded, a beautiful effect of black shadow illumination will at once be recognized, and the intensity of the shadows are easily graduated at the will of the observer, in two ways; 1st, by a simple movement of mirror; and 2nd, by combined movements of mirror and diaphragm. The effects thus obtained are innumerable and within the reach of any intelligent observer.

This black shadow illumination gives promise of real value to those engaged in advanced investigations of structure, in fact, it will be found to be a new power. This simple and rude appliance has for weeks been a permanent *fixture* to the stage of my instrument, and the ferrotype plate seems to bear any amount of bending. Its functions are obvious, the iron plate simply shutting out rays more or less diffused. This little bit of a "fixing" constitutes, with the mirror, all the "sub-stage apparatus" I have any use for in the resolution of severe tests.—*From the Cincinnati Medical News, February*, 1875.

Diagnosis of Blood Stains.—Dr. Woodward vs. Dr. Richardson.

In view of Dr. Lemmon's challenge in regard to the diagnosis of blood stains, we have been asked to republish the following record, which is taken from the *Cincinnati Medical News*, for April, 1875. In reply to our request for a copy of the letter, Prof. Smith writes us as follows:

"It may be proper to say, that the blood stains furnished by Dr. Eames included those of man, ox, sheep and horse. I beg to add that my efforts in the matter of diagnosis of blood stains were suggested only by my thorough convictions of the validity of the positions claimed by Dr. Richardson. It will be noticed that I used higher amplifications than did Dr. Richardson, although my objective was only a low 1-6th, and this objective, with 1-8th solid eye-piece, would have given good images amplified nearly 8,000 diameters, and will bear to be so used when necessary. Finally, in general, the microscopist will occupy safer ground when he states simply his own observations, such as they may be, rather than when he prejudges the capacity of other observers."

To the Editor of the Cincinnati Medical News—I notice in the *News* of last month your reprint of Dr. Woodward's article attacking the positions previously assumed by Dr. J. C. Richardson.

As many of your readers may not have Dr. Richardson's papers (read before the Biological and Microscopical Section of the American Academy of Natural Sciences), it may be proper to say in brief, that Dr. Richardson simply claimed that, under an amplification of 3700 diameters (or more), as furnished by modern instruments, he was able to detect the red blood corpuscles of man from those of ox, sheep, deer, cat, goat and horse.

Dr. Richardson goes thus far, and no farther; he wisely abstains from the discussion of blood corpuscles of other animals which approximate to those of man, thus witholding information that perchance might prove of service to the rogue.

Dr. Richardson, in support of his position, prints in detail six experiments, proving that in *each instance he did detect* the corpuscles of man from those of the ox and sheep. Dr. R. says: "In conclusion, I submit that the results of my experiments above narrated *prove* that, since the red blood globules of the pig, (1-4230); the ox, (1-4267); the red deer, (1-4324); the cat, (1-4404); the horse, (1-4600); the sheep, (1-5300); and the goat, (1-6366); are also much smaller than even the ordinary mininum size of the human red disk, as measured in my investigations, we are now able, by the aid of high powers of the microscope, and under favorable circumstances, to positively distinguish stains produced by human blood from those caused by the blood of any of the animals just enumerated, and this even after the lapse of five years from the date of their primary production."

It is remarkable that Dr. Woodward should entirely dissent from this view of the matter, that human blood corpuscles can be distinguished by microscopic measurements from those of the lower animals, named by Dr. Richardson, *without offering some positive evidence in support of his assertion.* On the contrary, Dr. Woodward does not disprove a single word of Dr. Richardson's paper. Dr. Woodward does, indeed, discuss some of the difficulties which environ the diagnosis of the blood of the dog, presenting well known facts, but in no wise overthrows Dr. Richardson's positions.

Even in the case of the dog, the writer of this cannot agree with Dr. Woodward, that it is certain the blood of the dog cannot, *under favorable circumstances*, be distinguished from that of man.

It is noticeable that Dr. Woodward with his usual candor, frankly admits that he has not yet "himself made systematic measurements of the blood of other animals than the dog." This has significance, and suggests that Dr. Woodward may yet find occasion to make further observations which when published, will prove a valuable contribution to the medical jurisprudence of the day. At present, however, the detailed and successful experiments published by Dr. Richardson remain intact, and are not materially changed by the advent of Dr. Woodward's dissenting paper.

As to the other animals, enumerated by Dr. Woodward as presenting difficulties to the microscopist, to wit, rabbit, guinea pig, monkey, seal, otter, kangaroo, capybara, wombat, and porpoise, it may be said (so far as most of these are concerned), that American microscopists will seldom, if ever, (*in the nature of things*) be called upon in the capacity of "experts" to determine in regard to them, and any farther discussion of the blood disks of these animals may safely be dismissed.

My friend, Dr. William M. Eames, of this place, having read both the articles, referred to, and being desirous of submitting the matter to further tests, handed me a few days since specimens of blood stains, requesting me to detect if possible, by the aid of the microscope, those due to human blood. These specimens were marked by him *a*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, and *l*.

According to Dr. Eames, these stains were submitted to examination under the microscope. The objective used was a superb Tolles' four-system wet 1-6th, and one-fourth solid eye-piece, in connection with Tolles' amplifier, which nearly doubles the power; the amplification nearly 4000 diameters. The images of the various blood disks were "thrown down" on paper by the aid of camera lucida, and the transverse diameters of the blood corpuscles sketched thereon. The distance of the camera from the paper was rigidly maintained by the use of a strut, properly fitted to the eye-piece, and extending to the table. The illumination was furnished by an ordinary German student lamp. The objective was used throughout with systems closed, and optical contact made with *glycerine* in place of water; after ten hours of close, severe work, my observations were completed, at once written out, and forwarded to Dr. Eames.

Very shortly afterwards I went to the Notary Public, and *swore* that the specimens *f* and *i*, sent me by Dr. Eames, *were* human blood, as also that the other specimens were *not* human blood. During the evening of the same day I received from Dr. Eames the following note:

"FRIEND SMITH—Your report of the examination of specimens of blood stains I sent you is received. Much to my surprise, you have made no mistake in regard *to any* of the nine specimens submitted, the two marked *f* and *i*, are, as you pronounce them, human blood, also those marked *a c d e g h* and *l*, are, as you positively declare, not human blood. The specimens marked *d g h* and *l* were also correctly designated by you.

I regret that you were unable to find time to complete the investigations, so as to designate the remaining specimens. But am gratified to know that the object sought has been fairly accomplished, viz: that human blood can be distinguished, by the use of high magnifying powers, from that of the domestic animals, with which it is liable to be confounded.

I am also satisfied that only those who possess great skill in the use of the microscope can determine these questions with *certainty*. Very respectfully yours, WILLIAM M. EAMES."

J. EDWARDS SMITH.

The Bacillus as the Source of Anthrax.

IT was supposed to be a great discovery when microscopists announced the presence of the *bacillus* in the blood of animals with anthracoid diseases. The organism was received as the undoubted cause of the malady. But further researches throw serious doubts on this view. H. Buchner, and later, Prof. A. P. Fokker, of Göttingen, have shown conclusively, not only that there are varieties of malignant anthracoid disease in which the bacillus is not found in the fluids of the body, but they have proven that there is absolutely no difference at all—at least, none that can be detected by observers—between the so-called *bacillus anthracis* and the innocent *bacillus subtilis* found in any infusion of hay (*Centralblatt f. Med. Wiss.*, Oct. 30).

In fact, this and other facts which have been laid before the profession go more and more to show that neither bacilli, nor bacteria, nor micrococci, nor any other of these low organisms whose presence can generally be detected in the pathological secretions and in the fluids of the body when diseased, have any direct etiological relation to the diseases present. They are there, as are maggots in putrefying flesh, not as cause, but as result of the death or degradation of vital action.

There is a perceptible tendency visible within the last year, to go back to a chemical hypothesis to explain the etiology of epidemics. Spores and germs are not so popular as they were. Even the specific organisms of particular diseases are not on hand always when they ought to be, to support the theory of their *raison d'etre*. Last spring Dr. R. Albrecht announced, in the St. Petersburg *Med. Wochenschrift*, that after long search in two cases of relapsing fever he could only find three examples of spirochæta obermeieri in the blood. After the preparation had been left for six hours the number of these bacteria had increased, several being visible under the microscope in each field, and all moving actively. During the remissions the blood was examined daily, no organisms being at first visible; after the preparation had been left for some days in a moist chamber, however, they suddenly showed themselves at a somewhat later period than would correspond to the patient's exacerbations, and they appeared to develop somewhat more slowly in the preparation than in the living blood. Dr. Albrecht noticed that the spirochæta did not disappear after the death of the patient, for he found them in large numbers in the corpse, though they were motionless.

It is worth noting, that Dr. Jacobi, in his recent monograph on diphtheria, substantially renounces the theory of infectious germs, and takes his position among the believers in a chemical contagium.

Wickersheimer's Fluid.

We have been requested several times to give the formula for this preserving fluid, and do so, although it has been pretty generally published. The original formula was as follows: In 3000 parts of boiling water dissolve 100 of alum, 25 of sodium chloride, 12 of potassium nitrate, 60 of potassa, and 10 of arsenious acid. Let cool and filter. To every 10 litres of the filtrate, add 4 litres of glycerin, and 1 litre of methylic alcohol.

Its application differs with the special objects to be preserved. In general, the objects must be impregnated with it. If the objects are to be preserved dry, they are soaked in the liquid from 6 to 12 days, and afterwards dried in the air. Ligaments, muscles, and other animal objects remain perfectly soft and movable. Hollow organs, as lungs, intestines, should be filled with the liquid previous to immersion in it. After being taken out, and before drying, it is advisable to inflate them with air. Injecting the liquid into a corpse will preserve the latter completely, and the muscular tissues will always retain the natural color of fresh corpses.

The original formula has been recently altered, so as to facilitate its manufacture, and to make it better applicable for various purposes. Messrs. Poetz and Flohr, of Berlin, prepare two kinds, one intended for injections, the other for macerating and immersing bodies, etc. Their composition is as follows:

	For Injecting.	*For Immersing.*
Arsenious acid	16 grams.	12 grams.
Sodium chloride	80 "	60 "
Potassium sulphate	200 "	150 "
" nitrate	25 "	18 "
" carbonate	20 "	15 "
Water	10 litres.	10 litres.
Glycerin	4 "	4 "
Wood-naphtha	¾ "	¾ "

Glycerine Jelly.

Various formulæ for preparing this useful medium have been published. The following has been recently published by Dr. Edward Kaiser, of Berlin:

Soak 1 part of finest French gelatin in 6 parts of distilled water for about 2 hours; now add 7 parts of chemically pure glycerine, and for every 100 parts of the mixture add 1 part of crystallized carbolic acid. Heat the whole, under constant stirring, for 10 or 15 minutes, until all the coagula caused by the addition of the carbolic acid have disappeared. Finally filter the solution, while still hot, through very fine glass-wool which has been previously washed with distilled water.

The glycerine-jelly thus obtained is used, when cold, precisely like Canada balsam. It also forms an excellent embedding material for sections. If there is a risk of the objects falling to pieces after being cut—owing to their delicacy—it is necessary to leave them in the warm mixture until they are completely penetrated by the jelly. After the sections are completed and placed on the object-glass, that portion of the jelly which has permeated the tissues may be again washed out by a fine jet of warm water. Harder objects may likewise be embedded in this jelly, which latter may be hardened to any desired degree by treating it for 10 to 30 minutes with absolute alcohol.

A New Form of Fine Adjustment.

Mr. Gundlach has recently applied the well-known principle of the differential screw to the fine adjustment of the microscope, thus securing a delicacy that is unattainable by means of any direct-acting screw that is coarse enough to be durable. By means of an ingenious and simple device, one of the screws may be clamped, while the other is left free to act and thus a more rapid adjustment is obtained than is possible with the usual fine adjustment, while it is much more delicate than the rack and pinion. The only wonder is that this application of a well-known mechanical arrangement has not been made long ago.

Preservation of Dissecting Material.—The *British Medical Journal* gives an interesting sketch of the methods of the preservation of subjects in the London dissecting rooms. At Guy's the subjects are injected by the Howse method, with glycerin and arsenic, but are afterwards put into a carbolic acid solution. At St. Mary's, the injecting material is composed of vermillion, arsenic, plaster-of-Paris, and size. At Middlessex Hospital, arsenic in a solution of carbonate of potassium was used, the subjects being afterward wrapped in carbolic acid cloths. At University College, carbolic acid in glycerin is the injecting material. In other schools, chloride of zinc, bichloride of mercury, arsenite of sodium, arsenic, creasote and soda, etc., are used in various combinations. Not one of these schools, however, makes use of a solution of chloral, as first used by Dr. Keen, of Philadelphia. This is an economical and perfectly satisfactory method of preservation. Under its influence, subjects not only remain sweet for weeks, even in warm weather, but the muscular tissue retains its normal flexibility and brightness of color.

A Monocular Muse.

BY MARY H. WHEELER.

A Rotifer, deep in an eddy-swept pool,
By the leaf-shaded shore of a rivulet cool,

Contentedly lived in her own minute style,
Invisible, voiceless, but active the while.

And starlight and moonlight, and sunshine and storm,
Lent their varying hues to her transparent form.

And the o'erhanging branches dropped green shadows down
On the flickering sands of the water bed brown.

The minnows above her oft swam to and fro,
And naviculæ sailed o'er the pebbles below.

For the spring time had come with its warmth and its light,
And the cells of the desmids were verdant and bright–

Closterium segments divided anew,
And the horns of the fair scenedesmus grew,

And the rayed rhizopoda clung lightly between
The filaments of the spirogyra green—

For the season had sent her primordial thrill
Through all protoplasm and chlorophyll.

And the Rotifer, glad in her limpid retreat,
Wheeled through the fair water on cilia fleet.

But a Student, whose nerve cells and brain matter gray
Were attuned to the touch of the sun's vernal ray,

Came, wandering over the vivified sod,
To explore this fair pool with his bottle and rod;

And he gathered spores, larvæ, and desmids a few,
Some diatoms fresh, and the Rotifer too.

Transferred to the slide of a microscope stage,
And held by a cover-glass close in her cage,

Did the Rotifer sigh for her home in the pool,
And for freedom to roam through its water ways cool?

In the close compressed water and unchanging glare,
Did she long for green shadows and free-flowing air?

Oh, no, she exhibited no such emotion,
But by wheeling and turning soon gave us a notion

She was rather enjoying the new situation,
Though too busy to rest from her old occupation.

And we said it was better this short life to yield
To the great cause of science, in microscope field,

Than to live its few days out, unseen and unknown,
In ever so pleasant a pool of her own.

Giving this as the fruit of our deep cogitations
The Student we left to his long lucubrations.

Pittsfield, N. H., March, 1881.

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High Magnifying Powers.

A RECENT number of the *Journal of the Royal Microscopical Society* says: "In America, more than one professed microscopical expert—notably, Mr. John Phin, Editor of the AMERICAN JOURNAL OF MICROSCOPY, and Carl Reddot's—has lately alluded to 80,000 or 100,000 diameters as within the power of his appliances," and the tone of the article would seem to imply that we advocate and use such high powers, although this is not expressly stated.

Speaking for ourselves, we would say that we have never used such powers, do not believe that any useful result is to be gained by them, and in all our writings we have opposed their use. It is true that we have experimented in this direction just to see how poor the results would be, and we have recorded the attempts of others, as a matter of news. But we are no advocates for such high powers, and never use them.

That a certain magnifying power is necessary in every case to enable the eye to appreciate what the microscope pictures, is a truth which needs only to be stated to command assent. The man who tries to see the lines of *P. angulatum* with a power of 100 diameters will fail—no matter how good his objectives may be. But our power to obtain amplification is limited, and we believe that the limit of effective work falls far below 80,000 diameters.

It is now pretty well recognised that very high power objectives do not reveal anything more than those of moderate power, it being assumed that the latter are of first rate quality, and used with high eye-pieces, and the question comes up: "How high may the eye-piece be?" Our own impression is that the same circumstance which prevent the successful construction of high objectives will prevent the construction and employment of high eye-pieces. Just where the limit lies it may be difficult to state, but we doubt the efficiency of any eye-piece higher than a one-eighth. This, with an objective of one-tenth, would give 8,000 to 10,000 diameters, and this seems to be about the limit arrived at by our best workers.

Our Book Table.

Practical Hints on the Selection and Use of the Microscope: Intended for the Use of Beginners. By John Phin, Editor of the *American Journal of Microscopy* and the *Young Scientist.* Third Edition. Thoroughly Revised and Greatly Enlarged. With Six Full Page Plates and Seventy-six Figures in the Text. Price 75 cents. New York: Industrial Publication Co.

This work has been out of print for some time, as the publishers were unwilling to send the old plates to press without thorough correction. The work of revision has been more extensive than was anticipated, and has occupied considerable time, but the advance sheets of the work are now on our desk, and the complete volume will be accessible to our readers before many days pass by.

The book we leave to other hands for criticism. That it has numerous faults we are fully aware, and we know that these have not been entirely eliminated. Fully one half the book has, however, been entirely rewritten, and the whole has been extended to 240 pages, instead of the 181 of the former edition. The kind reception accorded to the first and second editions, leads the author to hope that the present one will not be entirely unacceptable to our young friends who are interested in microscopy.

How to See With the Microscope. Being Useful Hints Connected with the Selection and Use of the Instrument: also Some Discussion of the Claims and Capacity of Modern High-Angled Objectives, as Compared with those of Medium Aperture. With Instructions as to the Selection and Use of American Object-Glasses of Wide Aperture. By J. Edwards Smith, M.D., Professor of Histology and Microscopy; Corresponding Member San Francisco, Dunkirk, and other Microscopical Societies, etc. 12 mo., 410 pp. $2.00. Chicago: Duncan Bros.

Microscopists in every part of the world have looked forward with considerable eagerness to the publication of this book, so that an earnest and cordial reception is at once assured for it. Those who expect a scientific treatise on the microscope will be disappointed; those who expect plain, practical directions on the best methods of using objectives of high angle will be more than satisfied.

Starting out with the means which are necessary to enable us to do justice to the best objectives, Prof. Smith takes up the question of stands, and points out the essential features which every stand employed for the higher class of work ought to possess. He then describes in detail the peculiar characteristics of the modern objectives, and passes on to the methods of illumination, which have been found to be the best. Having discussed these points, he takes up the subject which every writer has found to be the most difficult, viz: directions for the practical application of the principles which he has just elaborated. This he does in a series of twelve lessons in which the practical directions are clear and pointed.

It is not a book which can be reviewed in a few lines. As Prof. Smith himself tells us, the subject is one which cannot be taught by mere written or verbal instruction, it requires patient labor on the part of the student himself, and it is only by this that success can be secured.

During the interval which has elapsed between the first announcement of the book and its issue, Prof. Smith has labored faithfully over this part of the book which now contains the ripest results of his experience.

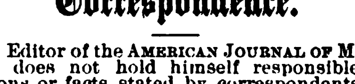
Any further attempt to review the work in our limited space would be futile. It is to be regretted, perhaps, that the present edition contains numerous typographical blemishes which will serve as food for the critics, but which cannot mislead the intelligent student. These affect the appearance of the work, but not its intrinsic value, which is such that no worker with objectives of high angles can afford to be without a copy.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

A Question of Practical Optics.

Ed. Am. Jour. Microscopy.—As soon as I saw the new work "Microscopical Technology," by Dr. Carl Seiler, announced, I at once procured a copy and read it carefully. The Doctor is a worker, and everything that he says is the outcome of personal experience, so that his book is a great help to those who wish to become successful workers with the microscope. There is one thing, however, which puzzled me, and that is the figure which Dr. Seiler gives of the blood corpuscle when seen by a microscope properly arranged. I refer you to the cut on page 18 of his book where Fig. 1, shows a "Blood disk with proper illumination;" Fig. 2, "Blood disk with bull's-eye removed." Fig. 3, "Blood disk with mirror out of centre." Fig. 4, "Blood disk without condenser."



Figs. 1, 2, 3, 4.

Here it will be seen that Dr. Seiler holds that the true appearance of a human blood corpuscle in the field of the microscope is a perfect circle with an outline so sharply defined that it is reduced to a single line.

Turning to several standard works on histology, I find that the accepted shape of the corpuscle is that shown in the figure given in Stricker's "Manual of Histology." [Here reproduced as Fig. 5.—ED. AM. JOUR. MIC.] Here it will be seen that the blood discs are rounded on the edges and slightly biconcave, and the view which Stricker, or rather Rollet, who wrote this chapter, gives of the side of the disc is also shown, and is very different from that given by Dr. Seiler. Which is correct?

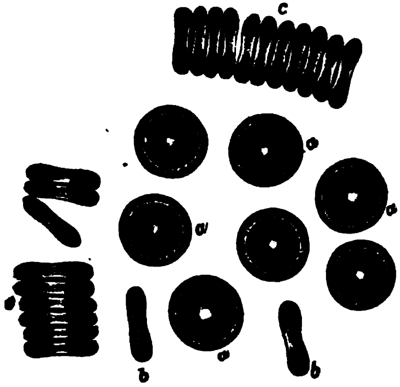


Fig. 5.

It seems to me that if we accept as correct the edge view of the corpuscle given by Stricker, then it would be impossible to obtain *by proper illumination*, such a view as that given by Dr. Seiler, as the correct one. For the only solid figure, composed of transparent material, that could give the appearance referred to, is one like Fig. 6, a simple disc like a gun wad; in other words a section of a cylinder with parallel faces at right angles to the axis. This is not the view I and my friends have been accustomed to get of blood corpuscles, even with very good apparatus. Are we all wrong?

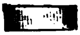


Fig. 6.

AN OLD PLODDER.

American Society of Microscopists.—Next Meeting.

Ed. Am. Jour. Microscopy.—I am authorized by the President of the American Society of Microscopists to announce to its members, and to all others who may be interested, that the Executive Committee have decided, by an almost unanimous vote, to accept the invitation received from the Tyndall Association of Natural Sciences, of Columbus, Ohio, and to call the next meeting of the Society at that place on Tuesday, Aug. 9th, 1881, (the week previous to the meeting of the American Association for the Advancement of Science at Cincinatti).

Permit me to add a word upon another matter. The Proceedings of the American Society, which should have appeared two months ago, have been unavoidably delayed by circumstances which I shall explain to members at the time of issuing the volume. The latter is now in the press, and will be sent out before the end of the month.

ALBERT H. TUTTLE, Secretary.

Columbus, Ohio, March 1, 1881.

An Ideal Series of Objectives.

Ed. Am. Jour. Microscopy.—I have read with unalloyed pleasure the article on the above subject in the last issue of the JOURNAL. Gov. Cox has taken a step in the right direction.

Readers will notice that the series of objectives above presented are selected from the standpoint of the ideal—that is. they would, if obtainable, best fill the requirements of the working microscopist.

The writer of this—as readers of the JOURNAL will attest—long ago presented a series of objectives, recommending the same as best fitted for microscopical work, which were chosen from the standpoint of a protracted experience "over the tube." These objectives may be enumerated as follows:

First. A Spencer 2-3rds inch, aperture 45 to 47 degrees, having a working distance of 1-4th of an inch, thus suitable for wet mounts *without covers*, and resolving 35,000 to 40,000, lines.

It will be seen that this objective comes tolerably close to the ideal inch of 40°, both as to resolving power and working distance of the two. The 2-3rds will be found the superior glass.

Second, A "real good honest" 1-2 inch of 40°, recommended as a "hack" and for work over acids, etc.

Third. A first class wide-angled duplex objective, say a 1-6th or a 1-10th, resolving all the most difficult tests.

Thus far, the two series of glasses keep pretty well together, and the owner of either series would probably have little occasion to complain.

The writer has many times acknowledged that the jump from the 2-3rds to the duplex 1-6th or 1-10th is a pretty wide one, and as he has elsewhere stated, it has been found impracticable to find a suitable "intermediate" glass. The nearest approach met with thus far is found in his Tolles' dry 1-4th. This objective has 100° of aperture, resolves 70,000 lines to the inch, and has much the longest working distance of any 1-4th of similar aperture and resolving power, viz: 1-25th of an inch. Furthermore, the writer has never met with the second glass, (i.e., 1-4th dry), even from the laboratory of Mr. Tolles, having the same aperture, resolution, and *working distance*.

The ideal series presents us with a somewhat similar glass, viz: the aperture and resolving power are coincident, but that these two conditions can be secured with all the tremendous working distance of "one-eighth of an inch," is something which the writer has in the past presumed impossible; certain it is he has never met with such an objective among the hundreds he has handled. Nevertheless, he gladly admits that such a glass would be most desirable, and would, undoubtedly "bridge his chasm."

Let him repeat, that Gov. Cox is doing a good work, in which it is hoped he will never tire.

J. EDWARDS SMITH.

Cleveland. Hom. Hospt'l College, February, 1881.

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A Dream.

Ed. Am. Jour. Microscopy:—

"I dreamed a dream,"

Yes, this night, and I record it before escaping my mind as I was just "off watch"—matters not my occupation—and should have been in bed, but feeling like rest before sleep, drew before a comfortable, fire rather an odd-looking table, on one end of which stood a peculiar shaped revolving book stand, the opposite part being loaded with various instruments. After amusing or instructing myself, which ever it was, I took my seat in a large easy chair on the other side of the table close to the book stand.

Thinking and looking in the fire, I dozed, and as I dozed, I dreamed, and in my dream I seemed like "*Tityre, tu patulæ recubans sub tegmine fagi,*" whilst, to the music of my slender pipe, danced and frolicked upon a fair open field in front of me a set of images, I knew not what. They were not human beings, yet seemed playful as little children. Soon, others acting like intelligent beings appeared, treating the little ones kindly, and they in turn much delighted thereat. A portion of this second set seemed to resolve into two separate classes, in appearance somewhat like "Jack Sprat and his wife"—I am not too old to read "Bob's" nursery books, and at times with as much interest as the author previously quoted; hope I may never be too old for that—one long and lank, the other broad and fat. After a while the frolicking ceased, the little ones scampered off, and then high words began among the others, which soon led to fighting like human beings. What could it mean, and how, in my dream, I was tortured to solve the mystery. Ah! I had it—saw *water* flying—a regular *Baptizo* was among the clergy; but no, it could not be, for I saw oil, and when the clergy fight the Old Adam gets the ascendency of them so completely that they do not play the part of the Good Samaritan, by the pouring of oil." Friends from all sides flocking in, the fighting gradually ceased, the extremists withdrawing, leaving the middle men on the field. Frequent messengers were sent to the extremists, especially the "broad fat ones," and occasionally a messenger would remain becoming one of them. "Oh for a solution of this."

Just at this point of my dream, I was startled by a *crash*, and a glance at my table gave the interpretation—a free fight of the object glasses. From this I infer that while we may fight our high and low angled glasses, *well corrected* medium angled glasses will be the *more generally in demand and useful for the masses;* still as manipulation improves, the wide angled objectives will be sought after, as being by far the more perfect. These objective fights, unlike clerical ones—[NOTE. The writer is not a scoffer; on the contrary he considers the *clerical profession* the higest calling of man; still the foibles and errors of the *professors* of that *profession*, of whatever denomination, he considers as justly amenable to rebuke, as errors in scientific matters. Visions of a moral lecture, doubtlessly well meant, inflicted when a boy, because he *dared* to accept the *truths* of Geology, have not been dimmed by a lapse of forty years. At that time such works as Hugh Miller's "Reconciling Geology and Mosaical Account of Creation," and Phin's "Chemical History of Six Days of Creation," were not in existence; had they been, how the boy would have exulted in respectfully confronting his lecturer with them.]—result in good both to the professor and profession; brings out greater manipulative skill, and improves our opticians, and, consequently, our optical instruments.

Now, I have a fair share of objectives, two, three and four systems, dry and immersion, adjustable and non-adjustable, from 3 inch up to 1-16th, and aperture from 12° up to 180°, all of which have a good moral character. I like them, as they tell me the *truth*, nor do I believe one of them would tell me a lie should it chance—(allowing me to change that little historical hatchet story to suit locality)—to cut one of my favorite orange trees with a cane knife. True, their language is different, and any seeming conflict in statements I find attributable to my false interpretation of their language.

The *crash* referred to happened thus: Evidently during my doze I had nodded against Bartlett, causing him to strike Blackham in the side at an angle of nearly 90°, reflecting at the same, made an angle infinitely near 180°, the resultant of which did not even leave a scratch on Blackham, although he came in contact with Davies and Peck, who, in their turn, made divers geometrical figures with the contents of the table requiring much mathematical calculation to rearrange, and not content therewith, toppled Frey on my lamp, giving a specimen of "truly diabolical illumination." In this fall Frey knocked Wythe face foremost against the stage of my Beck's stand, where he quietly rested as if in a trance. As I took him up, (page 57) he was murmuring "*Am. pel.*,—been resolved, 1-16 Powell & Lealand im—sunlight. Solution, Am. sulph. copper, etc." Well, I rather like Wythe, and, as I carefully cared for him, remarked to myself, "I think he has been working too hard, and, like myself, been 'dreaming—*dreaming of the past.*'" In connection with this fall of Wythe's, there was quite a remarkable coincidence; viz: At the time, I had on my stand Bausch & Lomb's 1-6 im. 180°, which asked very small favor (condensing lens) of the *Am. pel.*, which was under it.

As I commenced to put things in order, there stood Smith (J. Edwards) and Beale, confronting me, the latter apparently astonished, but on the face of the former there was a good natured expression which said as plain as daylight, "I rather like it."

The only damage done during this melee was the cremation of one poor little French triplet, his epitaph being, "kind remembrance for the good he did in years long since past."

GREY BEARD.

In the Swamps of Louisiana

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Oneida Co. Microscopical Society.—The regular monthy meeting of this Society was held at its rooms, Monday evening, Feb. 28. Dr. Smith Baker read a paper on the "Microscopical Uses of the Cat." The paper was a plea for the more universal use of this superfluous domestic animal in microscopical study. He deplored the seeming preference displayed by most authors of microscopical literature for the rabbit and guinea pig, as proper material for experiment, and proceeded to show how much the cat is to be preferred to either of these comparatively expensive animals, for studying the tissues and organs. He also gave a full and complete description of the operation of injection, and the subsequent operations of hardening, cutting and mounting. The paper was illustrated by a large number of neatly mounted, injected, and stained sections of the tissues of the cat. Other members of the Society also exhibited mounts bearing upon the subject of the paper, and, after the reading, the evening was occupied in examining and discussing the various objects. Mr. Mallory was appointed to read the paper at the next meeting, March 28. GEORGE C. HODGES, Secretary.

Wellesley College Microscopical Society.—The regular meeting of the Wellesley College Microscopical Society was held Monday evening, Feb. 28, the President, Miss Hayes, in the chair.

A paper on sponges was presented by Miss De Viny; also one on shells, by Miss Alice Gold. These were illustrated by drawings.

Professor Whiting gave a talk on snow crystals, illustrated by original drawings, with some remarks as to the supposed causes of crystallization.

Under the microscope were displayed: 1. Sponge spicules, three slides. 2. Microscopical shells, displaying most of the generic forms. 3. Copper thrown from a volcano. 4. Crystals of chlorate of potash. L. F. CLARKE, Cor. Sec'y.

American Microscopical Society.—At the annual election of the American Microscopical Society of the City of New York, held February 9th, the following-named Board of Officers was elected for the year 1881: President, John B. Rich, M. D., 12 East 22d Street, N. Y.; Vice-President, John Frey, Bellevue Hospital, N. Y.; Secretary, O. G. Mason, Bellevue Hospital, N. Y.; Treasurer, T. d'Oremieulx, 7 Winthrop Place, N. Y.; Curator, George Wale, Paterson, N. J.

Communications and packages for the Society should be addressed to the American Microscopical Society of the City of New York, care of the Secretary.

This Society meets at eight o'clock P.M., on the second and fourth Wednesday of each month, at No. 12 East 22d Street, New York City.

O. G. MASON, Secretary.

EXCHANGES.

Wanted. American algæ, zoophytes, insects and microfungi, in exchange for British. R. H. Philip, 28 Prospect Street, Hull, England.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, N. England.

A Baker stand, also a new imported $12 Zither, to exchange for first-class objectives. Box 107, Astoria, L. I.

The Lathe and Its Uses, etc., for a Nobert plate or a Micrographic Dictionary. E. Pinckney, Dixon, Ill.

Wanted, a foreign microtome in exchange for a C clarionet, in good order and worth $35. T. S. C., Asylum, Toronto, Canada.

THE AMERICAN
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AND
POPULAR SCIENCE.

Vol. VI. NEW YORK, APRIL 1881. No. 4.

How to Examine a Plant Microscopically.*

I HAVE selected this subject for my discourse this evening with the view of enlisting your sympathies on behalf of one of the most interesting, and perhaps one of the least worked, branches of microscopical research. It may not, at first, appear a very suitable subject to be brought before such an Association as the one I have the honor of addressing this evening; but I hope to justify myself later on by proving to you that the microscopical investigation of plants is not only an interesting employment, and one tending to intellectual development and advancement, but has a practical bearing upon matters connected with the occupations of your every day life.

My assertion, that the examination of plants by means of the microscope is an occupation of interest, may possibly strike some of you as the utterance of an enthusiast, for I am afraid that many microscopists of experience vote plant-structure as about as dry a subject as they could touch, and only interesting to philosophers of the Dr. Dryasdust school—the reason probably being that they only know plant-structure as represented by divers slides, illustrative, as it is said, of stem and cell-structure, which have from time to time found their way into the cabinet; and they have in no case examined, in any true sense, even those mummified productions of the mounter's art, much less made any comparison between the various slides they have, with the view of tracing any relationships or differences between the several "structures" or "tissues" on the slides. There are, in fact, two or three classes of microscopists abroad in the land. There is, for instance, a great class which has recently been happily described as the "brass and glass" school: men who possess very fine stands, with all kinds of mechanical appliances and lenses, but whose minds are pretty nearly as mechanical as their microscopes. These men addict themselves chiefly to finding out what is new in the brass and glass line; and such intellectuality as is unrestrained within them is devoted to more or less vain attempts to find new striations on fine diatoms, or to make a ¼ in. objective do the work hitherto done by a 1-6 in. or 1-8 in. To such men the thanks of the scientific microscopist are doubtless due; but when I once heard an eminent man of the higher school express as much, I thought it was the lion of research thanking his jackal. A second and much higher class of microscopists is represented by the man who may or may not possess a very elaborate microscope, but who possesses a good collection of objects, not necessarily of his own preparation, and who makes an intelligent study of them, with the help of the best books at his disposal, and, may be, dabbles a little in pond-life as well. Such a man may often be met at soirées or conversaziones, and is usually a pleasant fellow, ready to give any amount of information respecting his exhibits. The third, and highest class of microscopist is not so common, and if you meet him at a soirée you generally find him looking somewhat out of his element. He is the man we should place before us as our ideal, not for his soirée characteristics, but for the kind of microscopist that he is. I mean he is a man who regards his microscope almost purely as a working tool, wherewith he can do something out of which shall come knowledge. You need not go beyond the bounds of your own trade in this town to find such a man, and the best thing I can ask you to do is to ask you to imitate his patient work if you wish to become a microscopist in the highest sense of the term.

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*A Lecture delivered before the Leeds' Chemists' Association, Feb. 16th, 1881, by H. Pocklington, F.R.M.S.

This somewhat long introduction leads me to the subject of my lecture, "How to Examine a Plant Microscopically," out of which I should like to evolve a question further, and make it the sub-title of .my discourse. How to become a true microscopist as regards plant structure, and evoke from you and myself a living answer that we have become such a one. There are two ways in which I might treat my subject to-night: the one is by way of a general outline of the principal lines on which to travel in plant microscopy; the other a description in detal of the methods pursued in the full and ultimate examination of some one plant or classes of plants. The first appears to me to be the best adapted for one of the purposes of my lecture, which, you will remember, is to enlist the sympathies of the non-microscopist or non-botanical microscopist on behalf of this department of intellectual work. Treating the subject, then, from this somewhat elementary platform, on account of which my apologies are due to advanced microscopists present, I will begin with a short account of the appliances needful, and follow with a rapid sketch of some of the methods pursued in the examination of a plant by means of the microscope.

First, then, as regards the instruments necessary. That some sort of a microscope is needful goes without the saying; but that that which the brass and glass man would consider a microscope is essential is quite another matter. I feel inclined to lay some stress upon this point, because, in my limited experience of people, I have found many men of considerable taste for microscopy who, in answer to the question whether they have an instrument, reply that they have not, because they cannot incur the expense, which they believe to be considerable. And I happened to know the father of three sons, all microscopically inclined, who was met with condolence on on their expensive tastes, when he happened to mention their tastes to a friend of his. To set all such minds at rest, let it be said at once that a microscope quite competent for the work of a plant microscopist, in all excepting a very few points, may be purchased for a sum not exceeding five pounds, and that a fully-equipped microscope for all his work need not cost five pounds more. And if my own experience goes for anything, it goes to prove that a man's best days begin to wane in microscopy when he purchases his first "refined apparatus." All *work* can be done with very simple and inexpensive appliances; it is a question of the workman much more than of his tools.

The so-called Hartnack model, either in its original form, or in one of its many modifications by Swift,* Baker, and others, appears to me to be the best form of stand for working purposes. It has no unnecessary complications, it is of small size, its stage is firm and affords sufficient room, and is of a convenient height from the table, and withal admits of the use of a variety of slides, hot and cold, electric and otherwise, with great facility, and it can be put into a corner, in a box, or under a shade out of the way when not wanted; but always at hand when required. As for lenses, an inch objective and a quarter-inch, or fifth, are needful. If a 2 in. and an eighth can be afforded in addition, so much the better; but they are not essential in nine researches out of ten. A bulls-eye condenser for the illumination of opaques, and, if it can be managed, polarising apparatus, complete the microscopist's equipment, so far as the optical matters are concerned—that is he has become possessed of his microscope when he has obtained so much. Beyond the microscope, he will want a few glass slips. 3 in. by 1 in., a few thin glass covers of different sizes, a few watch glasses, and small earthenware pots furnished with lids, such as are used for putting up tooth-paste and the like, a few stoppered bottles of about 2 oz. capacity, and a few pieces of glass tube, such as is used in feeding-bottles; a sharp razor or two and a few needles stuck in pencil-holders, a wash-bottle, such as is used by chemists, which of course, you can easily make out of a jelly bottle, a piece of cork and two glass tubes, a little gold size, Canada balsam, glycerine, and a few other matters which I will name as I proceed. These will answer all your purposes, and fully equip a more than usually well-furnished working laboratory, and will be quite sufficient for all the work an ordinary microscopist is likely to do. Their cost in addition to the microscope, need not exceed 20s., and very likely will not cost gentlemen in your profession more than 5s. or 10s., so that you will be able to have your complete equipment, microscope included, for something under six pounds, and I very much doubt whether the same expenditure would secure so large a revenue in the way of constant employment for leisure hours, and so large a result in the shape of intellectual work and its resultant growth, and true recreation and rejuvenescence.

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*Particularly Swift's.

I will now ask you to prepare for a first lesson in microscopy, with the assumption on my part that you have learned only this much—that you can take the microscope out of its case, screw on the objective, and examine a ready-mounted slide with ease, but have not made any use of it in practical work. I am perfectly aware that as regards many of you, probably of most, it is an unwarrantable assumption, and that you are perhaps better microscopists than I am; but, for the sake of those who are beginners, I will ask you to allow the assumption to stand, and bear patiently with me.

Whenever it has been my good fortune to take an embryo microscopist in hand, as during the last score years has happened occasionally, I have made a special point of two things; first, begin with something simple and always obtainable; second, let that something be something which, besides presenting the qualification of being always procurable when wanted, has a habit of frequently turning up when not wanted. Therefore, I have begun with fungus spores, a course which is now-a-days followed from a somewhat different reason, in all well drawn-up courses of biology, and is, as you know, laid down in the South Kensington Botany and Biology syllabus, as also in Huxley and Martin, Rutherford's and other text-books. I will begin, then, with the examination of yeast.

Procure a little yeast from any brewer, or sow German yeast in sugar-and-water a few days before you want it, and having arranged your microscope with the 1-4 in. objective (or better still, a 1-5, 1-6, or 1-8, if you have one) ready for use, clean a few glass slips and covers. Place a little yeast upon one slip, add a drop of water, cover with a thin glass, and examine. Probably the first thing you will call the attention of your guide, philosopher, and friend to, if you have one by your side, will be some circular, ring-like bodies, with bright or dark centres, which appear much more interesting than the oval particles near them. Your guide will probably withdraw his eye from the microscope very promptly, and utter with unusual energy, and just a suspicion of contempt, Oh, they are bubbles. Never you mind: they are well worth your study, and the best thing you can do is to examine these said bubbles very closely, and make so thorough an acquaintance with them as shall enable you to recognise them ever after, for assuredly you will find them occurring in the least expected places. But, having disposed of the air-bubbles, begin to examine the oval particles of which the yeast consists; make drawings of them; observe how some of the corpuscles are quite separate and distinct, and how some of them have little buds attached to them, and some bigger buds; how some of them appear to have little fluid hollows, or vacuoles in them, and carefully observe whether there are not little bits of something floating as it seems in the fluid of these vacuoles, and finally measure these corpuscles by means of the eye-piece micrometer. Having thus obtained a superficial knowledge of yeast, you may proceed a step further. First make a solution of Judson's magenta in water to about the color of red ink. Place a drop of this solution at one edge of the thin cover over the yeast-cells, and apply a piece of blotting paper to the opposite side of the cover, when the water on that side will be withdrawn, and the magenta solution will follow it under the cover. Examine afresh, and note that the contents of the yeast granules become deeply stained, but that the vacuoles do not; press the cover a little, and you will see that the contents of the yeast-cells are expelled, deeply stained, having a sort of bag, which, if stained at all, is stained very slightly. Now prepare a fresh slide of yeast in water, as before. Then make a solution of iodide of potassium in water in about the proportion of 3 gr. to the ounce, adding, when dissolved, 1 gr. of iodine. Apply this to the slide, as before, and observe that the contents of the yeast cells are deeply stained brown, the cell-bag slightly yellow. Next take some yeast, as dry as you can, and stain it with tincture of iodine, place it on the slide as before, and apply tolerably strong sulphuric acid. Notice that the cell-walls or cell-bag is stained purple and blue. Having done all these things carefully, you may, if you have time, apply strong solutions of caustic potash, of acetic acid, solution of carmine, and various other things, and carefully observe the effects; but for my present purpose we have done enough, and have learned that there is an outside bag of these yeast-cells which stains blue with sulphuric acid after iodine, and that there are contents which do not, but do stain intensely with iodine alone, and with magenta. The outside, we may learn further, but must take for granted now, is composed of a substance called cellulose, and the inside of a substance which is called protoplasm. The one is the horny substance, the other its dwelling or environment. Having learned this much, we have gone a considerable distance towards becoming plant microscopists; for we have learned that a plant consists of a substance which stains red with magenta, brown with iodine, can be squeezed out of its envelope, and otherwise acted upon, without respect to its environment, which substance we call protoplasm; and of a box, bag, or envelope in which the substance is contained, that is composed of a substance which turns blue when acted upon by sulphuric acid after being stained yellow by iodine. That is to say, a simple plant cell of yeast is so constituted. This is not the simplest form of cell-life, for we have cells without cell-walls; but it is sufficiently elementary for our purposes to-night. The next question to be dealt with is that as to the nature of what we call plants in every-day life. If I were to-night in the position of a lecturer opening a course of lectures which would extend over several weeks, I should take you over the region of botany step by step, and show you as best I could how the one-celled plant became the two-celled plant, and how the big tree passed from a unicellular condition into the very multicellular oak or elm; but as it is, I must proceed by leaps and bounds, and ask you to pass at once to the examination of some homely plant, keeping before you the main facts arising out of our examination of the yeast-cell.

If you take any succulent fruit, such as a strawberry for instance, and make a thin slice or section from it, placing it under your microscope, you will observe that it consists of a number of little bags, larger than those of the yeast-cells, but having a rough general resemblance to them, and more or less globular in form—especially in that part of the slice or section which is towards the interior of the fruit. These cells are not single or isolated, but coherent, and you will readily surmise that the difference in shape which they manifest are largely due to the circumstances in which they find themselves; *i.e.*, the normal spherical form is more or less developed by pressure. If you apply the chemical tests I have just described to such a section, you will find that the contents of the cells stain brown with iodine as before; but you may, perhaps, perceive here and there in the contents of the cells small specks of blue, which I daresay you will suspect to to be starch granules, and very correctly. You will find, further, that the membranes of these cells stain blue with iodine and sulphuric acid, and will surmise that the character of the cell-wall and cell-contents in both cases are essentially identical. You may now examine the fruit more in detail, and you will find that the cells forming the membrane of the fruit differ very widely from those forming the soft interiors, but that they do not materially differ in their chemical reactions. You may thence be prepared to meet with cells of very different shapes, but of essentially the same biological structure, that is, they will contain protoplasm and have cellulose walls. By-and-by you will find that in mature growths of the higher plants you may find cells which, at the time of examination, contain no protoplasm, and which manifestly have a wall which is either composed of something different from cellulose, or of cellulose that has partly changed its character; but these new facts will in no way lead you from the great fact—that the cells were once such as I have described, and that what you are then examining are post-mortem cells, in which the active processes of life are extinct, or at least practically so.

With this much before us, viz., that cells may be found coherent and not isolated, but manifesting the essential characteristics of single cells, and that they may be found manifesting great changes of form, due to pressure and other causes; and are also found as dead cells, minus protoplasm, and plus something else, we may pass to a further stage in the examination of a plant—that is, to the examination of the stem or root of one of the higher plants. Taking one which you may find in the drawers or cupboards of, I presume, every chemist's shop in the country—the common liquorice-root. A fresh specimen is best for examination, but a dried one will answer the purpose, or you may take any stem or root that you like, and work the subject over at your leisure.

Taking, then, a stem of liquorice-root, make a thin slice through it in a direction at right-angles to its length, and place it on the slide in a little water. Possibly you cannot make much out of it, as the cells appear to be filled up with all sorts of things. In this case, which happens very often with other vegetable preparations, run a little solution of caustic potash (liquor potassa) under the cover, hold the cover in place by an American clothes-peg, or, better still, a small clip of wire, and heat the slide for a few moments over a spirit-lamp till the liquid boils; then allow it to cool, and run water in under the cover by the blotting-paper method till you have removed the caustic solution. You will most probably find the section is cleaned, so that you can examine the shape of the cells of which it is composed. If it be not clean, run a little dilute sulphuric acid (1 acid to 5 water), and heat as before, removing the acid immediately. The section will then assuredly be clear, and if you fail to observe the sharp outline of the cells, you may be satisfied that the section is too thick, and the best thing you can do is to cut another. Having thus secured a thin and transparent section, you may proceed to its examination, beginning at the centre or pith portion. You will observe, first of all, that this occupies but a small part of the area of the root, probably not more than one-fifth or at most one-third of the diameter; that it is principally composed of cells which are nearly circular in outline, and when you come to examine a section cut longways of the stem, you will find that these cells are nearly globose. You will observe that these cells are relatively of large size as regards the other cells in the stem, and that these walls are much thicker than were the walls of either the yeast-cells or the grape-cells you previously examined; and that neighboring cells do not quite fit in with each other, as is, indeed, a necessity of the case arising from their shape, although this has been somewhat modified from the true globe or oval by pressure. If you run in a little magenta solution you will find that these thickened cell-walls stain a little more deeply than the fruit cell-walls, but on testing with iodine and sulphuric acid they turn blue, proving them to be cellulose, but thickened cellulose. Running in iodine alone, you will notice that certain apparently granular bodies turn to the characteristic blue of starch, but that certain other bodies present do not. (If you have used acid in cleaning the slide, you will not find these bodies at all). Examining these last bodies closely with the ¼ in. objective, you will observe that they are distinctly crystalline, and on the application of acid they dissolve with evident evolution of gas, and you may safely assume that they are crystals of some salt of lime.

Taking a section which you have not boiled or cleansed, and examining the starch-granules of which you have only found traces in the other preparation, you notice that they are of very tolerably uniform shape and size. In shape, nearly egg-shaped, with a distinct elongated cavity-like mark, which is called the hilum, at one end, and if you use your polariscope you will find that no black cross is perceptible, and that the granule is nearly black on the black ground of the polariscope. The crystals, similarly examined by polarised light, become very brilliant, and are beautifully colored.

Having thus examined the central portion of the stem, we take the next area, which extends over about one-third of the diameter of the root, and we at once notice that its structure is essentially different from that of the central portion; the cross-section of the cells shows that they are of very different size. Many of the cells are small, have very thick walls, and others are much larger and have, relative to their size, much thinner walls, and that some cells run in lines from the centre outwards. If we run in magenta, we find that all these cells stain much more intensely than the cells of the central portion, but some more so than others, and, running in iodine and sulphuric acid, we observe that they do not stain blue so readily, sc wholly, or so intensely as the walls of the pith. But in a cross-section we cannot make out much more than this about them, so we will examine a section cut longways; that is, a longitudinal section. Examining this section, we notice that nearly all the cells are of greater length than their small cross-section would lead us to expect; that, in fact, they are many times longer than they are broad; that those cells which were of greater diameter are extremely long, and, in fact, do not look like cells at all. We will examine the small ones first. We notice that such of them as form the lines running from the centre of the stem to the outside, and called the medullary rays, have tolerably thin walls, and answer to the tests of our chemicals pretty well after the fashion of the fruit cells, making allowance for the evident superior thickness of wall. The long cells with small cross-section, we notice, have moderately thick walls stain pretty deeply with magenta, and stain rather dark brown with iodine. They are not quite the same as ordinary cells of cellulose, and we should find these characteristics much more marked if we were examining a section through an oak or other hard-wood stem. Testing such cells with sulphuric acid after iodine, we do not get the complete cellulose reaction, but if we test them with acid nitrate of mercury, we get a distinct red coloration which may lead us to suppose that some deposit other than cellulose has been made on the walls or in the walls of such cells. This thickened matter we call lignine. All the cells hitherto examined have tolerably even walls without roughness or perforation; but we observe that the large outlined cells have thicker walls, and that there are numerous markings on them which look like perforations, and we notice also that the walls which should have formed the terminals of these cells have been either wholly or partially removed, and that they run continuously as tubes or vessels for some distance down the stem. These cells answer our chemical test similarly too, but more intense than the woody cells last described.

Outside this layer we find a series of looser tissues, chiefly composed of thin walled cells, globose or changed to cubical, with contents somewhat the same as those of the pith, and, interpersed with them, aggregations of small outlined cells, which prove to be long tube-like cells when examined longways, and finally, towards the outside, layers of cells containing little or nothing and much compressed, till at last the backs and fronts of the cells nearly meet.

To sum up all this and apply it to practical purposes, we may state it in the form of an answer to a question: "What course am I to pursue in making an examination of a stem by means of the microscope if I wish to draw up a description of its microscopical structure? leaving out of account the results of my chemical tests which I have applied to make myself familiar with the fact, that all cells had something in common, or not having it now, have had, or will have, if they live long enough, and have the same function to serve."

We make careful sections in three directions, across the axis, vertically through the axis, vertically at right angles to the last, midway between the axis and the pith, and carefully examine each of these sections with a view to answering the following interrogations.

* First, Is there any pith? If so, are its cells colored or not? What is their general shape and size? Are their walls thick or thin? Have they any markings, in the form of perforations or otherwise. Are there any very thick-walled cells in the pith (as in Hoya)? Is there any starch in the cells? If so measure the granules, and describe their shape and action upon polarised light when immersed in any given medium. Do the cells contain any crystals? If so, what is their shape and arrangement within the tissues? Test the crystals microchemically, in order to learn their composition. Estimate their average number in different sections.

We must next attack the layer of tissues immediately outside the pith, and ascertain whether or not that layer forms what is known as the vascular sheath, and is chiefly composed of vessels which in long section appear to contain a spiral fibre or fibres, loosely wound round their interior, and are known as spiral vascular vessels in consequence. If the spiral fibre be present, we must ascertain whether it is single or double, and wound in a right or left-hand direction, or one fibre one way and the other fibre the other. Does the sheath completely encircle the pith, or does it form the basis of wood wedges extending into the general structure of the stem? We may now examine the medullary ray system;

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*See *Pharmaceutical Journal*, vol. ii. p. 782. "The Microscope in Pharmacy," by H. Pocklington.

that is the series of cells extending in line from the centre to the circumference of the stem, like the spokes of a wheel. Are these rays made up of one line of cells, or of how many, arranged side by side? Are the walls of these cells pitted or not? What are their cell contents (paying special attention to any crystals that are present)? How far are they apart on the average? Do they all extend to the circumference of the stem? We next examine the vessels found in the woody layer. Are they pitted or not? are they barred? septate or not? what is the size? Are they numerous, and how distributed in the other tissues? Next, as regards the wood cells. Are these pointed at their ends or nearly square, thick walled or thin, dotted or not? Finally, what is the general shape of the wood wedge between each pair of rays?

Then comes the examination of the bark, in which we have to follow very similar lines, paying special attention to the shape and situation of the liber bundles, and special contents of any of the cells, or special modification of them by secondary accretions.

Time does not permit me to carry our imaginary lesson on to the examination of leaves, fruits, etc., but after you have made yourselves familiar with the examination of stems on the lines laid down this evening, you will not experience any serious difficulty in making an examination of any portion of a plant. Bear one thing in mind: make sure of every step, and never cease your examination of any stem, seed or fruit, until you have made yourself familiar with every cell in its structure—so familiar, that you can recognize its identity when and wherever you see it again, if you intend to make your microscopical study of plants useful in your business as an aid to the detection of adulterations. The usefulness of the study from this point of view will come home to all of you, and I am not sure that this is placing the study upon a low platform, after all. But your study of microscopical biology need not stop here. The "Comparative Anatomy of Plants" has yet to be written, and such of you as have the leisure, may profitably spend a portion of it in laying some of the lines on which the Cuvier or Owen of the future may write the companion volume to the "Comparative Anatomy of Animals."

Those also who fear that such a notion is altogether Utopian, may turn from the path of analytical and descriptive anatomy, and embark in the study of microscopical biology, a field which has hitherto been almost entirely left open to the German and French botanist, whilst energetic Englishmen have confined themselves to "making hay." The same instruments and largely the same appliances will serve you here as in the work I have to-night indicated. You will want more patience, more manipulative skill, and, above all, you will want a large share of that spirit of reverent curiosity which alone enables a man to become truly scientific. The study of "life in plants" is not so attractive, because not so sensational as many other studies, the results of which have from time to time been brought before you. You will not lose yourselves in the immensities of space or of numbers, or bewilder yourselves in attempting to form some conception of the nature, the motion, and the forces appertaining to a molecule or an atom, or be tempted to an apotheosis of yourselves as creators of a new chemical: but you may find yourselves, flower in hand, uttering as earnestly, if not as beautifully, the thoughts of our great poet:—

> "Flower in the crannied wall,
> I pluck you out of the crannies,
> Hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is."

— American geologists are asked to compete for the prize of $1,000 to be given at the approaching International Congress of Geologists at Bologna, for the best international scale of colors and conventional signs for graphic representation of formations on geographical maps and sections.

Remarks on the Nomenclature of Achromatic Objectives for the Compound Microscope.

BY DR. J. J. WOODWARD, U. S. ARMY.

FOR some years past, while most of the Continental opticians have continued to give arbitrary designations to their achromatic object glasses, such as No. 1, No. 2, etc., or System A, System B., etc., the English and American manufacturers, affecting a higher degree of accuracy, have undertaken to name the objectives they construct, by their real or supposed agreement in magnifying power, with single lenses of specified focal lengths. We hear accordingly of inch, half-inch and quarter-inch objectives, etc., by which we are expected to understand combinations agreeing in magnifying power with single convex lenses of the focal lengths named.

At first sight nothing could appear simpler or more exact than such a nomenclature; nevertheless recent articles in the journals would seem to indicate that the general plan is capable of considerable modification in its practical application, and that grave misunderstandings have hence arisen.

Under these circumstances, it appears desirable to give some account of the principles involved, and of the practical difficulties to be considered in their application, particularly as the microscopical text-books contain little or no information on the subject. In fact the only scientific discussion of the matter with which I am acquainted is the paper of Mr. Charles R. Cross, "On the focal length of microscopic objectives." (Journal of the Franklin Institute, June, 1870, p. 401). This paper gives a reasonable formula for the approximate computation of equivalent focal lengths, and furnishes some other valuable information, but does not discuss all the points at issue. I shall have occasion to refer more than once to this excellent paper, which the reader would do well to examine in connection with the following remarks.

We learn from the elementary treatises on optics that when an object is placed in front of a single convex lens at a distance somewhat greater than its focus for parallel rays, a real image is formed on the other side of the lens, which may be received on a screen. This image will be larger, and, formed at a point more distant from the lens, the nearer the object approaches to the focus for parallel rays; and two equations are given which express the relationship of the distances to each other and to the magnifying power, viz:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{p'}, \text{ and } \frac{p'}{p} = m,$$

in which f is the length of the focus for parallel rays, p the distance of the lens from the object, p' its distance from the image, and m the true magnifying power, that is, the size of the image divided by the size of the object; p and p' are termed the conjugate foci and are variable quantities; f is termed the principle focus, and has an unchangeable value for each single lens.

If now we combine the above equations, representing $p + p'$ or the sum of the conjugate foci by l, we may deduce the formula

$$f = \frac{m\,l}{(m + 1)^2}$$

which represents in the case of any single convex lens the relationship existing between the length of the principal focus, the magnifying power, and the distance from the object to the screen. This formula, which I think rather more convenient than that of Mr. Cross, differs from it only in using m = the magnifying power; instead of n = the reciprocal of the magnifying power; it may be deduced from his by substituting for n its value $\frac{1}{m}$ and reducing, or it may be derived directly from the primitive equations. In either shape the formula yields the same numerical results, and if for any single convex lens m and l are given, the accuracy of the value of f resulting, will be limited only by the degree of precision with which m and l have been measured.

If now there were any such actual equivalence between achromatic objectives and single lenses as the nomenclature assumes, it would only be necessary to set up the objective to be rated, in such a manner that the image of a micrometer should be focussed upon a white screen, using of course no eye-piece, to measure the distance from the micrometer to the screen, to determine the magnifying power by measuring the image of the micrometer, and substituting these values of *l* and *m* in the working formula to calculate the value of *f*. Unfortunately, however, if with any compound objective we repeat this operation several times, merely varying the distances, we obtain as many different values for *f* as there are distances used, instead of obtaining but one value for all distances as we do with a single lens.

Mr. Cross (loc. cit. p. 409) has already pointed out this circumstance which results from the fact that the modern achromatic objective has considerable thickness, from its anterior to its posterior surfaces, and that it has properly speaking no true optical centre. He gives two examples, in one of which a change of 5·24 inches in distance corresponded to a change of ·0067 inch in calculated focal length; in the other a change of 6·10 inches in distance corresponded to a change of ·0029 inch in calculated focal length, the objectives used in the experiment being uncorrected 1-4ths, so called. If, however, Mr. Cross had used for this purpose lower powers, or had made greater variations in the distances employed he would have found much greater discrepancies. For example, by measuring the magnifying power first at 25 and then at 50 inches, and deducing the value of *f* by the formula of Mr. Cross, I obtained in two cases the following equivalent focal lengths. For a so-called 1¼ inch, at 50 inches distance, 1·2187 inches; at 25 inches distance, 1·2468 inches; difference 0·271 inch. For a so-called 1-5th, at 50 inches distance, ·1982 inch; at 25 inches distance, ·1893 inch; difference ·0089 inch.

Moreover, since the achromatic objectives of different makers are constructed on different series of curves, and the component lenses placed at different distances apart, it will be found that if two achromatic objectives magnify the same at any given distance, they will no longer do so if the distance is materially changed.

Hence I am compelled to agree fully with the observations of Mr. Cross (loc. cit. p. 401), that the nominal focal length assigned to an achromatic objective can only serve in any case as "a general appellation serving to group together objectives of *approximately* the same magnifying power," and must conclude, therefore, that the English and American nomenclature possesses no real claim to strict scientific accuracy, and especially that the comparison made by some with the case of the celestial telescope is not valid.

But besides the inevitable inaccuracy resulting from this source, there are in the case of the higher powers of modern makers two other sources of much more considerable error. The first of these involves the case of all those objectives which are provided with a screw collar to correct for thickness of cover; the second involves the case of objectives with two fronts, one for wet and the other for dry, or those with but one front which can be used wet or dry by merely changing the correction given by the screw collar.

The correction for thickness of cover is made, as is well known, by changing the distance between the front combination of the triplet and the posterior two combinations. As a consequence, the magnifying power of the objective at any given distance, or with any given eye-piece, is least when the objective is corrected for uncovered, and greatest when it is corrected for the thickest cover through which it will work. The ratio of this change is very different in different objectives. I select a few from my note book in illustration, purposely omitting to name the makers.

	Magnifying power at uncovered.	*Magnifying power at covered.*
No. 1	200	225
No. 2	250	275
No. 3	300	333
No. 4	350	500
No. 5	570	630
No. 6	900	1100
No. 7	975	1180
No. 8	890	1250

These values were obtained by throwing the image of a micrometer on a card board screen, using the objective without an eyepiece, and the distance from micrometer to screen in each case remained the same, the screw collar and the focal adjustment of the objective being modified. Of course, for all intermediate positions of the screw collar intermediate values result. The distance used was 48 inches in some of the cases, 50 in the others. With shorter distances, the amount of the difference is diminished, but its ratio to the magnifying power at uncovered is not materially changed, as any one can convince himself by comparing a stage micrometer, as seen by any corrected objective, with an eyepiece micrometer, first at uncovered and then with the full correction for cover.

Now it is evident that even if, by the formula of Mr. Cross, or otherwise, we could obtain accurate equivalent focal lengths for any one position of the cover correction, the result would not be true for any other position of the cover correction.

We are told by a recent writer that the practice of the opticians is to name the combination at its performance uncovered, that is, at precisely the adjustment least used. If, however, scientific accuracy in the matter is desirable for any purpose whatever, it is evident from the above that at least the maximum and minimum should be furnished by the maker.

It is also evident that the considerations here offered, aside from their bearing on the nomenclature of objectives, have a high practical value to all those who attempt to make micrómetric measurements with modern high power objectives; for the practice recommended in the text-books, and too generally pursued, is to give values to an eye-piece micrometer by comparing it with a stage micrometer at a fixed position of the draw tube, and to use these values in subsequent measurements. Now as these values vary considerably with the cover correction, it is to be feared that the majority of the measurements made with high powers during the last twenty years are sadly inaccurate.

The difficulties in the way of a nomenclature based upon equivalent focal lengths have been still further increased since the introduction of immersion objectives. The compound objective is usually furnished with two fronts, one for wet and one for dry use. Of these the wet usually gives the greatest magnifying power at any given distance. I have also measured an objective which, when corrected for the thickest cover through which it will work dry, is just corrected for uncovered wet, and by approximating the posterior pair of combinations still nearer to the anterior, corrects for cover wet, thus increasing the magnifying power when the objective is in use wet precisely as if two fronts were used.

The difference in magnifying power resulting from the modifications given to make the objective perform wet is quite considerable, as may be seen by the following extracts from my note book.

	Magnifying power.			
	Dry.		Wet.	
	Uncovered.	*Covered.*	*Uncovered.*	*Covered.*
No. 1	225	250	250	275.
No. 2	425	490	450	500.
No. 3	700	900	900	1000.
No. 4	770	910	900	1100.
No. 5	790	930	975	1180.

Of these objectives No. 1 had but one front, the correction for wet being made by the cover correction; the others had two separate fronts, one for wet, the other for dry.

Now it is just in connection with these complex objectives, with double fronts or other devices to correct for wet and dry, that the greatest diversity of nomenclature exists. In one quarter it is claimed that the system should have two names, one based on its magnifying power at uncovered wet, the other on its magnifying power at uncovered dry; in other quarters the practice has been to give the system but a single name derived from the magnifying power at uncovered dry alone. It is evident, however, that neither of these plans has any pretension to scientific accuracy, and that if the makers will not give at least the maximum and minimum for both dry and wet, the purchaser must learn to measure for himself.

A similar remark applies to the angle of aperture as stated by the makers, for each objective sold. As a rule they give the greatest angle attainable by the conbination, which is generally—not always—the angle at the correction for thickest cover, their usual practice in this case being the reverse of their usual practice with regard to magnifyng power. Now I have seen objectives with an angle of 170° and upward at full cover correction, which did not exceed 140° at uncovered. It is evident, therefore, that the maker should furnish with each glass both the maximum and minimum angle, or the microscopist must measure for himself.

After a full consideration of all the circumstances, I am disposed to think that the best interests of both makers and purchasers would be consulted if the present nomenclature were abandoned altogether, and objectives named instead by their precise magnifying power without eye-piece at some selected distance. It would be well if all the makers could be brought to agree on some fixed distance; but until we obtain this happy uniformity, which perhaps is not to be anticipated, it is only necessary for each maker to state the distance he selects. By this plan objectives without correction for cover would be named by one number, objectives with correction by two, and those with two or more fronts or backs by two or more pairs of numbers.

Thus we should have objectives without cover corrections named precisely 2, 3, 4, 5, 6, 7, 8, 9, and so on up to 100 or more, the number indicating the exact magnifying power, say at twelve and a half inches from micrometer to screen. Objectives with cover corrections would be named 30 to 40, 35 to 46, 75 to 89, 125 to 140, etc., the numbers representing the minimum and maximum magnifying powers at the selected distance. Objectives with wet and dry fronts would require a separate name for each; thus 78 to 95 dry, 98 to 130 wet, etc.

By this plan the real magnifying power of the glass and its limits of variation would be accurately stated, whereas at present even those makers who are most careful about their nomenclature do not hesitate to call a glass a 1-8th provided its power at uncovered approximates that of a single lens of 1-8th of an inch focus more nearly than it does a 1-6th or a 1-10th. Hence glasses which differ materially in magnifying power at uncovered, receive the same name, and the changes in power produced by the cover correction, are invariably ignored.

If the plan I here recommend be adopted, the precise distance from micrometer to screen which may be chosen does not appear to me to be of very great importance. Many persons would I suppose prefer 10 inches to 12½. I have selected the latter number because many of our larger stands have tubes too long to permit the convenient measurement of low powers with eye-piece and stage micrometers, in the manner I shall presently describe, if the distance be taken at 10 inches, whereas on most stands, with the help of the draw tube, 12½ inches can be used conveniently with all powers from the three inch upward. I do not, however, insist on any particular distance, but only that the distance selected shall be stated in each case until some uniform plan shall be generally agreed upon.

In this connection I may add that the actual plan of the Continental opticians is also unsatisfactory. In the matter of angle of aperture, when they give it at all, they also, as a rule, give only the maximum. In the matter of magnifying power, when they give any information, they attempt, as a rule, to give the magnifying power of the objective with each eye-piece as actually looked through when in use. But as the magnifying power of the combination under these circumstances involves the distance of distinct vision for each observer, it is evident that the figures thus furnished cannot have any practical value.

Pending the adoption of some such system as I have suggested above, it will be necessary for the microscopist to measure for himself the magnifying power of the objectives he uses, whenever he desires to be possessed of the real information concealed behind all the several systems of nomenclature at present in use. Mr. Cross in his paper gives two modes of doing this. I myself have been in the habit of using a dark room, and throwing the image of the micrometer on a white screen, by the direct rays of the sun. Very nearly equal accuracy may be attained, however, by any microscopist who possesses an ordinary glass eye-piece micrometer and a stage micrometer. The glass eye-piece micrometer, it will be recollected, is slipped through the eye-piece in such a manner as to be just in the focus of its eye-glass, that is, in the plane which is occupied by the image formed by the objective when it is seen most distinctly. If now the field glass of such an eye-piece be removed, and the stage micrometer carefully brought into focus, a comparison of the divisions of the eye-piece and stage micrometers will give the magnifying power of the objective alone at the distance actually existing between the two micrometers. Thus, for example, if the stage micrometer is in 1-1000ths and the eye-piece micrometer in 1-200ths of an inch, five times the number of eye-piece divisions corresponding to one division of the stage micrometer will be the magnifying power of the objective at the cover correction employed, for the distance selected. We may then apply the following simple rule, derived from the formula of Mr. Cross.

Multiply the distance between the two micrometers in inches and decimals, by the magnifying power, and divide by the square of the magnifying power plus one; the result will be the equivalent focal length (for the given conditions) in decimals of an inch.

It will, moreover, be found in practice that for powers equivalent to those of a 1¼th or shorter focal lengths a still simpler rule may be adopted, and that the distance between the two micrometers, divided by the magnifying power, will give very nearly the same results as are obtained by the more complex rule. but this of course is not true for lower powers.

It must, however, be constantly borne in mind that the results obtained in any case are true only for the cover correction and distance used.

For the convenience of those who may undertake such comparisons, I append a table in which the real magnifying powers of single convex lenses are given for three different distances. In the treatises on optics the magnifying powers of single lenses are sometimes stated at some given distance from the lens to the screen, but I know of no table which shows their powers at given distances between image and object.

Table of the Magnifying Powers of Single Convex Lenses.

Focal length for parallel rays.	Magnifying power at 12½, 25, and 50 ins. distance from micrometer to screen.		
	12½ inches.	*25 inches.*	*50 inches.*
3 inches	1·50	6·17	14·59
2 "	4·00	10·40	22·95
1½ "	6·17	14·59	31·30
1 inch	10·40	22·95	47·99
2-3rds of an inch	16·69	35·47	72·98
4-10th "	29·21	60·48	122·99
1-4th "	47·99	97·98	197·99
1-5th "	60·48	122·99	247·99
1-6th "	72·98	147·99	297·99
1-8th "	97·98	197·99	397·99
1-10th "	122·99	247·99	497·99
1-12th "	147·99	297·99	597·99
1-15th "	185·49	372·99	747·99
1-16th "	197·99	397·99	797·99
1-18th "	222·99	447·99	897·99
1-20th "	247·99	497·99	997·99
1-25th "	310·49	622·99	1247·99
1-50th "	622·99	1247·99	2497·99

This table is calaulated by substituting the numerical values of f and l in the equation

$$f = \frac{m\,l}{(m+1)^2}$$

when $m =$ the magnifying power remains

as the only unknown quantity and is easily computed. I have carried out the values of *m* to two decimal places only; but in practice the nearest whole number will be found sufficiently accurate.

Note.—Since writing the foregoing article, I have read with pleasure a paper on the same subject by Dr. R. H. Ward, ("Remarks on uniformity of nomenclature in regard to microscopical objectives and oculars," *American Naturalist*, March, 1872, p. 136). This paper contains much valuable matter, and should be read by all who are interested in this subject. I learn from it for the first time that the method of determining the magnifying power of objectives by removing the field glass of the eye-piece and using eye-piece and stage micrometer as described above, has already been used by Dr. J. J. Higgins, of New York (*American Naturalist*, December, 1870, p. 628), to whom I hasten to give the credit due.

I am very glad to find Dr. Ward indicates the feasibility of the substitution of magnifying powers at a fixed distance as names for objectives instead of alleged equivalent focal lengths. I must, however, differ from him when he recommends that the distance should be measured from some part of the objective to the screen, instead of from the micrometer to the screen; for however desirable this may be made to appear, it is not feasible. Nor can I agree with him in regarding ten inches distance as having anything special to recommend it. To the question he asks at the conclusion of his paper, "at what point of the screw collar adjustment shall the objective be placed for rating its angular aperture and amplifying power?" I reply without hesitation that for each purpose accuracy demands that the maximum should be given as well as the minimum; that the maker should state not merely one limit, but both.

Dr. Ward's paper also contains some interesting suggestions on the subject of the nomenclature of eye-pieces, a matter which will, however, I think, particularly in the case of the ordinary eye-piece, require further discussion. I agree fully with Dr. Ward that eye-pieces should be named by their magnifying power: but the question at once arises, how shall this be accurately measured? To this subject I may recur at some future time.—*From The American Journal of Science and Arts, for June, 1872.*

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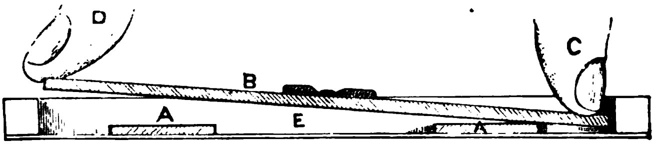
A Convenient Slide Lifter.

BY J. T. BROWNELL.

FOR economy of space and readiness of examination, as well as to guard against the evil of the settling of objects to one side, slides should be kept lying flat in trays.

To facilitate the lifting of the slides out of the pockets of the tray, several ingenious plans have been adopted. One is, to have the bottom of the pocket bevel-sunk at one end, so that by pressing upon the end of the slide, it may be tilted and drawn forward and out. But this requires that the tray bottoms be of wood, or other material thick enough for the purpose. These thick-bottomed trays have given way to the lighter and more elegant paper bottoms. With these the plan is to have a gouge-bevel in the front end of each pocket for the ready use of the finger tips in reaching the end of the slide.



SLIDE-LIFTER.

But this arrangement has its disadvantages, in that with the greatest care the labels are liable to become soiled and mutilated; and in the case of thinner slides one has to make use of some slender implement, as a pencil point or a toothpick.

The device which I have hit upon obviates all these difficulties, and is, at the same time, simple and inexpensive. It has met with the unqualified commendation of all who have seen it. The accompanying engraving will set it forth at a glance.

The circular pieces, A, A, are punched out of thick card board (I make use of cast-off paper boxes which any dry-goods merchant furnishes me for the asking). The pieces are half an inch in diameter, and are placed 3-8ths of an inch from the ends of the tray pocket, being secured in place by a little paste or a small drop of mucilage. By pressing down upon either end of the slide it becomes tilted so as to be readily drawn out of the tray.

In addition to the superior advantages of this arrangement over all others which I have seen, may be mentioned the fact that the slides may be laid in the trays *cover downwards*, and thus transported without danger of soiling, or otherwise injuring, the finish on the rings, in case the package should be turned bottom upward.

Lyons, N. Y., Feb. 2, 1881.

Microscopical Examination of Vaccine Virus.

In the "Proceedings of the Medical Society of the County of Kings," is an interesting report by the Committee on Hygiene, on the "causes of alleged futile and bad results following vaccination." Dr. N. B. Sizer, of the committee, gives the following results from the microscopical examination of vaccine virus; 58 specimens were examined, viz:

20 Fresh Lymph.
1 Cone.
15 Ivory slips, charged by Dr. S.
20 Ivory slips, commercial charging.
2 Crusts.

In twenty specimens of fresh lymph, only three contained the shining micrococci (so-called vaccine corpuscle). In eleven out of the twenty, despite care, red blood corpuscles were detected, absent *only* when the *spontaneously exuding* lymph alone was used. Any attempt to increase the yield by pressure or manipulation being followed by slight hæmorrhage, perhaps microscopic only. Of the fifteen slips charged by Dr. Sizer, Nos. 1 to 5, inclusive, charged with freely exuding lymph, contained no red blood cells. Nos. 6 to 15, where slight pressure was used, *all showed red blood cells.* Twenty slips, from various sources, showed eight with red blood cells; one, a *humanized slip*, contained blood enough to show a pink color.

The cone was composed largely of *debris*. The following conclusions were reached:

1. The presence of blood in vaccine virus is easily detected by the microscope.
2. Blood is a frequent contamination of commercial lymph in a dried state.
3. Its presence is probably due to an effort at obtaining as large a portion of lymph as possible.
4. Its presence is highly dangerous in humanized lymph, but probably of no account in that from the calf.
5. The "so-called vaccine corpuscle" has not been found in quantity or at times sufficient to render it undoubtedly a specific appearance due to vaccine. It appears to be merely a micrococcus.
6. Vaccine cones as now offered in the market are undesirable forms of transmitting lymph.

Crusts which were examined consist largely of necrosed tissue. Probably only the thin, transparent top layer, is usable.

A Permanent Mount of Equisetum Spores.

I have been so pleasantly impressed by a mount of the spores of *Equisetum arvense*, our common mares-tail, or scouring rush, that I think it must be told to the readers of this journal. It was made a year ago by Hon. E. A. Apgar, State Superintendent of New Jersey. This gentleman produces very beautiful, and skilful mounts, and he has hit upon a plan of a slide, which, although a year old, still shows the striking saltatorial phenomena of the elastic filaments of the equisetum spores. He makes a cell of a brass ring, and gum copal. On two opposite sides of the ring he files a small nick, or notch, so that when the mount is completed, there is a small hole on each side of the cell. Now put the slide in focus, let the spectator adjust his eye to the tube, and let some one give a faint puff of breath against one of the holes, and the spores will throw out their four clubbed feet, and go off into a quadrupedal hornpipe rather comical to behold.

S. Lockwood.

Freehold, N. J., March 30, 1881.

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—Repeated applications to copper or brass of alternate washings of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze.

THE AMERICAN

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AND

POPULAR SCIENCE.

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Important Notice.

We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II, III, and IV, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the American Journal of Microscopy. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

How to Use the Microscope.

We are happy to be able to announce that this work is now ready for delivery, and copies have been sent to all who have favored us with their orders.

The book is considerably increased in size and the present edition is printed on somewhat larger and finer paper, so that it forms a rather handsome volume. The price still remains the same as before—75 cents.

Dr. Woodward's Paper on Objectives.

Since the publication of Prof. J. E. Smith's book, "How to See with the Microscope," in which Dr. Woodward's paper is epitomized, and his formula adopted, we have had several requests to publish the entire article as it is not accessible to a large number of our readers. Dr. Woodward and the publisher of *The American Journal of Science and Art* having most liberally given us full permission to do so, we have given it to our readers in this issue, and it will repay a most careful study.

In this paper, Dr. Woodward alludes to two other articles—one by Dr. Ward, Editor of the Department of Microscopy in the *American Naturalist*, and the other by Prof. C. R. Cross of the Technological Institute of Boston. Both these articles are of great value, and as we have permission to publish them, it is our intention to do so. Dr. Ward has promised to revise his article, and we hope to be able to induce Professor Cross to snatch, from his other pressing duties, sufficient time to enable him to do the same for us with his article.

Postage Stamps.

We again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

Our Book Table.

Ponds and Ditches: By M. C. Cooke, M.A., LL.D. Price $1.00. London.

Anything from the pen of Dr. Cooke is sure to be interesting, and the present volume will not disappoint those who purchase it. It is written in a pleasant popular style, is liberally illustrated, and is one of those few books that combine scientific accuracy with simplicity and freshness of statement. Desmids, Diatoms, Hydras, Rotifers, Common Water Plants, Leeches, Worms, Water-Spiders, Mites, Water Bears, Water Fleas and Aquatic Larvæ form the subjects of the several chapters.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

What Beginners Want.

Ed. Am. Jour. Microscopy.—I read with no little interest in your excellent journal of January, the very interesting and clever letter of "Grey Beard," and although not yet a "Grey Beard," in fact have no beard at all, I am unfortunately a Bald Head. His views and mine exactly coincide. "A good editor is an educator;" and I write to strengthen his solicitation that *you* talk *yourself* of the many *little things* in microscopy, especially as to manipulation for beginners, such as most writers think too insignificent to speak about. Mounting, staining, preparing different classes of objects for mounting, explaining the different relations and co-relations of objectives and eyepieces, and giving simple rules for telling the diameters, etc., etc. In doing this, you will not only be obliging a great many of your amateur readers, increasing the interest in microscopy, but you will find that it will bear fruit that in years to come will repay you.

I had seen so many of the beautiful slides of Dr. Carl Seiler, had formed such a high estimate of his labors and work, that in purchasing his book, I fully anticipated that all my troubles were at an end. But, to work, according *to him*, presupposes a laboratory and work on the *wholesale scale*, which is anything but what a beginner wants. And then again he has written his formulæ in the Metric System, and thereby made a grave mistake, as his good sense ought to have told him that the Metric System is *not popular* with that class of workers for whom his monograph was designed, and never will be.

So, Dear Mr. Editor, devote a page or two of your journal to the "many little things," and I am sure you will receive the grateful thanks of many more besides Grey Beard and

BALD HEAD.

Roanoke Bottoms, North Carolina.

Hints for the Editor.

Ed. Am. Jour. Microscopy—"Gray Beard" and myself do not disagree. I am as anxious as he to read the "transactions," etc., but, *give us the transactions*, not other matters. The reports of societies are eagerly devoured by us all. We rise from such a repast hungry.

You say, however, that "it is not the object of a Journal to teach the elements of art or science." I never made any such proposition. Neither have you adhered to your own rule. It is your duty, as Gray Beard says, to teach the "little things," and "manipulation for beginners." As he says "a good editor is an educator." That is my position. You need not teach the "elements," unless you choose, but you *must* teach the practical application of them, or nothing. Let me instance a case where a few words from you would count. On page 21 of the JOURNAL, 1881, we read: "After evisceration by bleaching solutions, plant sections are unfit for study." In the JOURNAL, 1879, p. 157, Merriman says, "In no other way can the wonderful process of plant growth be made manifest." Now add a few ink drops from your own horn. The "three men of Gotham,"* in the JOURNAL, 1881, p. 22, say, "Put marine algæ in Goadby's solution," while Beale in his 5th edition of "How to Work," etc., at page 68, says the solution "has fallen out of use as a preservative fluid for microscopic specimens." Davies, p. 126 of 2nd edition, says it is used for animal sections; Beale says not. Davies also recommends Deane's compound for algæ. I think you can reconcile these matters, which sometimes appear strange to the beginner. We do not complain—we merely suggest for the future, which we appreciate, and thank you for the past.

EUGENE *et als.*

Another Growing Slide.

Ed. Am. Jour. Microscopy—In your journal, and elsewhere, descriptions of simple growing slides have appeared recently. I have made and tried them all, or at least all that have been noticed, and I have to say that all are useful, and, in great part, what they are held to be. I prepare, however, for my own use, a slide that may be considered a combination of good points suggested by those referred to above. I describe it as follows: Make a hole from ¼ inch to ½ inch in diameter, in the centre of a 3 inch by 1 inch glass slip, using slips of thickness to secure desired depth of cell; cement with marine glue a cover glass over the orifice—the cell is made. To use it, fill with water and object, cover with thin glass considerably wider than cell, or use uncovered; then place the slide with uncemented cover next to a plain glass slip, the two slips separated, however, by a piece of blotting paper of the same size, having a hole in its centre larger than the covering glass, and having also a tongue projecting from the middle of one edge; bind the slides together with rubber bands, and place over a dish of water, with the tongue of the bibulous paper dipping into it.

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*Our correspondent undoubtedly means the "City of Brotherly Love," instead of Gotham.—ED. AM. J. MIC.

The water in the cell can not dry up so long as that in the dish lasts. It is desirable to have some evaporation from the cell supplied by fresh water, put a thread reaching the blotting paper under the cover, and *cut away the paper on one side of the cell.* The cell-slide is removed for examination, or examined without separation; it may be examined either side up; so, also, when placed upon the dish, either side may rest uppermost, so as to get the desired object near either cover.

Concave slides may be treated in the same way, or, indeed, plain ones. When not a large quantity of fresh water must be supplied, this arrangement satisfies my need of a growing-slide. D. S. Kellicott.

Buffalo, N. Y., March 19, 1881.

Resolution With Moderate Angles.

Ed. Am. Jour. Microscopy—The following communication, if of sufficient interest, you may publish. Last Saturday evening, with a 1-6th of 120° angular aperture, of Gundlach's make, I succeeded in resolving the 18th band of Nobert's Test plate, with light of a kerosene lamp, using the mirror only for condensing the light.

I do not remember ever having seen an account of a "dry" 1-6th of so small angular aperture equaling the above. I used a power of 775 diameters.

The above was in the presence of two of my friends, who can testify that the 18th band was unmistakably resolved. C. M. Plummer.

Haverhill, Mass., March 14th, 1881.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

American Microscopical Society of the City of New York.—A meeting of this Society was held on Feb. 23rd, 1881, President Dr. John B. Rich, in the chair. After reading of minutes of last meeting, communications, and announcement of donations, by the Secretary, Dr. Rich exhibited his recently constructed Illuminator for opaque objects.

The apparatus consists of two lenses, one a meniscus, having about one and a half inch aperture, and the other a plano-convex of five-eighths inch aperture.

The two lenses are mounted in opposite ends of a conical tube of brass about two inches in length, which is attached to an upright stand, similar to that used with the ordinary bulls-eye condenser—by a very ingenious and efficient system of ball and socket joints—diminishing in size from the stand to the lens mounting; and so constructed with self-adjusting spring rings that the illuminator is held in any desired position, and also admits of every motion in any direction by one simple movement of the hand.

The connections between each ball and socket is such that the arm may be disconnected at such point as best suits the work in hand.

The lenses are so constructed as to give a pencil of practically achromatic light of great brilliancy, while the form of mounting and general arrangement of the optical portions renders it available with comparatively high powers; and its use is attended with far less inconvenience than the old form of bulls-eye illuminators.

After a general discussion and trial of various methods, Mr. Mason exhibited a new form of mounting forceps, which he had devised for handling discs or squares of thin cover-glass. The extreme simplicity of construction, with trifling cost, and the complete utility of the little instrument, made up of two or three bits of wood and four or five ordinary dressing pins renders it quite interesting.

A piece of wood about the size of an ordinary lead pencil, is, with a saw, split about one half its length. (or it may be split with a knife if the precaution is taken to prevent the split extending too far, by winding the central portion with thread); into the end of each side of the split, are forced two pins—at the outer or widest points. The heads of these pins are then cut off at a point about five-eighths of an inch below the wood, taking a little care that they are all of equal length, in order to bear evenly, when held upon a flat surface.

The two arms or sides of the pliers are then forced apart by a small cork or wedge inserted in the split near its termination at the upper or handle portion. By advancing or withdrawing this wedge, the space or opening between the pins—which form the clasping portion—is made to suit the diameter of the cover or object to be picked up. Care should be taken that the ends of the cut pins are well squared, as the angle left by the cutting nippers would prevent a good bearing upon the edge of the cover glass. The ease and certainty with which thin glass may thus be handled, and placed in the *exact* position desired, was highly commended.

After remarks by several members upon the mounting of objects the society adjourned.

O. G. Mason, Secretary.

Canandaigua Microscopical Society.—The regular monthly meeting was held in January. A paper was read by Major C. A. Richardson, on the subject of "Fermentation." The paper first reviewed the history of the subject, giving a brief sketch of the earliest experiments and theories.

The process of alcoholic fermentation was known and studied by the ancients, as we find frequent references to it in the literature of Greece and Rome, as well as in the scriptures of the Old Testament.

In 1862 Becher stated that saccharine liquids are alone capable of entering into alcoholic fermentation, and that the alcohol was the direct result of this process.

About the year 1700, Stahl, a German chemist, announced that vinous fermentation and putrefaction were phenomena of the some order, and were each brought about by a change in the molecules of the liquid.

The chemical theory of Liebig, which was developed in 1840, was next alluded to and explained. This made yeast to consist of organized gluten in a state of putrefaction, which, by its presence in a fermenting fluid, caused by chemical affinity a splitting up of its constituent parts.

The development of the present germ theory of fermentation was due to the experiments of Schwann, in 1838, and subsequently to those of Pasteur and Tyndall. The theory is, briefly, that all fermentation and putrefaction is due to the presence in the fluid of very minute round or ovoid cells which, under proper conditions of temperature, multiply with great rapidity, and by their multiplication and growth, take away from the fluid in which they are certain elements and form others; as, for instance, when sugar, in solution, is changed into alcohol and carbonic acid gas. In other words, these minute organisms, which require a high power of the microscope to be made visible, are really little plants of a single cell. These organisms are called ferments, and there is a different ferment for each variety of fermentation.

These ferments are divided into two general classes, soluble and insoluble. The soluble are little understood at present, but among them may be classed the peculiar ferment called diastase, which exists in the seeds of all plants, and which has the power of changing starch to sugar, when the seed germinates so that the young plant can feed upon the soluble sugar. Several substances in the digestive fluids of animals belong also to this class, as the Ptyalin of the saliva, and the Pepoine and Pancreatine of the gastric and pancreatic juice.

A good illustration of the other class of ferments is seen in the brewer's yeast. This was shown under the microscope in different conditions. The most interesting specimen showed the round cells of the yeast plant in an active state of growth, and by looking for a few minutes one could watch the process of budding, when a little cell protruded from the side of the parent cell. Two kinds of brewer's yeast were shown, the one called sedimentary, because it falls to the bottom of the beer vat and there does its work, and so forms the lager beer. Another called surface yeast, which works at the top and forms ordinary beer.

The ferment of bread or bread yeast was also shown and described. Likewise the peculiar ferment of wine, which is found clinging to the stems of grapes and other fruits, all prepared to set up fermentation when the fruit is bruised.

The structure of the yeast plant and its composition was minutely described, and the manner of reproduction.

In reference to the activity and numbers of these cells at work, it has been estimated that to change 1 gram (15·4 grains) of sugar into alcohol and carbonic acid requires some four hundred billion cells.

The ferments which cause putrefaction are different, being much smaller, and the product of their decomposition is largely ammonia and other gases. These are called bacteria and vibriones.

Vinegar is formed from alcohol by the action of a ferment called mycodermaceti, which is the mother of vinegar.

The paper closed with some reflections of a physiological nature, which summed up the whole subject in a masterly way, but it would be impossible to reproduce them here.

This sketch of the proceedings of the society for one evening needs no apology for its presentation to the public, and the object in view in so presenting it will be attained, if others still outside of the society shall be induced to purchase a microscope, and become participators in so interesting a study.

J. H. J.

Camden County Teacher's Association.—At the recent session of this Association (Saturday, March 19th, 1881), the members of the Camden Microscopical Society attended and gave an exhibition of interesting objects.

After the transaction of the regular routine business, County Superintendent Brace introduced Mr. C. Henry Kain, Principal of N. W. Grammar School of Philadelphia, who delivered a lecture upon "The Use of the Microscope in Teaching," which was listened to with marked attention throughout. The lecturer spoke of the importance of addressing the mind through the agency of the eye. Impressions thus produced are the most durable. Observation must precede generalization. A child who has once *beheld* the circulation of the blood, is eager to know more about so wonderful a process. His attention is secured and his mind is then in a state to receive further knowledge. Do not begin instruction in object teaching by befogging the young mind with classifications. *Observation* should come first, then *reflection* and *deduction*. The aim of the teacher should be: First, To see that facts are correctly observed. Secondly, To see that the child's mind is so guided in its reflections as to reach correct conclusions.

Following the observation of individual facts would come the study of resemblances, and this naturally leads to generalization and classification.

Microscopy is not an absolute science within itself. The great advantage of the microscope to the teacher consists in the fact that it wonderfully enlarges the scope of vision, giving the power to pry deeper into the structure of organized matter, and enabling us to know as facts many things which otherwise would be mere matters of theory. In the study of insects and plants the microscope is an absolute necessity. The lecturer described the curious breathing apparatus of insects, and also alluded to the wonderful adaptation of the various organs of insects to their particular uses and necessities. Reference was also made to the necessity of using the microscope in giving instruction in physiology, a study now taught in most schools. It is easy to interest even young children in the study of their own wonderful organization, provided pains are taken not to render it too entirely theoretical. A single view of a structure is often better than pages of description.

In speaking of infusoria, reference was made to some popular errors, one of which is the idea that every drop of water is teeming with animal life. Pure water contains no animalcules, but they are always found where decaying organic matter exists, and their office appears to be to convert this noxious decaying matter into living material by appropriating it to their own sustenance. The importance of interesting children in scientific study was spoken of, also the fact that a teacher who has succeeded in thoroughly interesting a child, is thereby unconsciously securing an immense hold upon the affections, thus often rendering even a troulesome pupil tractable and readier to receive instruction in other things.

The careful study of the works of the Creator is one of the greatest antidotes to atheism, and the evidences, everywhere so abundant, of a great overruling design in all the works of nature, are not matters to be lightly regarded in the instruction of youth.

After the lecture, the objects mentioned, as well as many others, were exhibited and described by Messrs. Brown, De Rousse, Fortiner, Bowden and Kain, of the Camden Microscopical Society. Several other members, who were unable to be present, kindly loaned their instruments for the occasion. R. & J. Beck, also Queen & Co., opticians, of Philadelphia, each made an excellent display of instruments.

EXCHANGES.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Prof. Smith's Book on the Microscope.

As we remarked in our notice of this work, there is in it abundant food for the critics, but at the same time it cannot be denied that it is the only work giving the modern ideas in regard to the advantages and best methods of using the wide angled objectives. That this is the opinion of others as well as ourselves, is shown by letters which have been addressed to us and to Prof. Smith. One gentleman writes from England that he is "more than satisfied with the book notwithstanding its obvious blemishes."

Dr. Parsons, of Meadville, Ohio, writing to the author, says:

Dear Professor—I have examined your work "How to See With the Microscope," and do not hesitate to say it is just the work we (the medical profession) need; I am more than pleased, I am delighted with it; I have long felt the necessity of just such a work as yours.

Yours, with great respect,
Edgar C. Parsons, M. D.

And the following letter from Dr. George E. Blackham, F.R.M.S., President of the Dunkirk Microscopical Society, requires no comment at our hands.

My Dear Smith—* * * I have no time now to enter into any extended critique, but can say on the whole that I am delighted with it. There are some points about it open to criticism, but these are chiefly, if not entirely, due to its having been written in the intervals of a busy professional life. * * * * All minor blemishes, however, fade away in view of the prime *fact* that you have given us the only real, practical treatise on the *use* of the microscope that is not twenty years behind the times; the chapters on selection of objectives, and methods of testing and adjusting them, are alone worth much more than the price of the book.

The thanks of the rising generation of microscopists are due to you for the only work on the subject that I am acquainted with that does not positively *mislead.*

I have read the book with great and genuine pleasure, and the further study will doubtless be productive of no little profit. I congratulate you most sincerely.

Yours truly,
Geo. E. Blackham.

Dunkirk, N. Y., March 21, 1881.

Extract from a letter from W. H. Walmsley Esq.:

Dear Prof.—* * * * * Let me at the onset congratulate you on the successful completion of your task and to predict that your work will cause a breeze in the microscopical world, such as no previous one on the same subject has done. I have done with it what I never did before, read it almost through at a sitting with absorbing interest. I unhesitatingly pronounce it the most original, bold, and reliable, at the same time practical and instructive work on the subject it treats of, that I have ever read. Of course it hits a few of my own pet notions hard, but for all that. I bow to its vigor, honesty, and heartiness, and regard its whole manner and matter as a triumph to yourself, and a boon to those into whose hands it may fall. I am no flatterer, as you very well know, but I consider it no more than justice to a hard worker like youself, to contribute my little meed of praise, and to let you see what profit and pleasure your work has already caused me; the same will occupy a place with the most choice volumes in my library.

Yours very truly,
W. H. Walmsley.

Philadelphia, March, 1881.

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The Model Stand.

BY HON. J. D. COX.

THE progress made within a few years in the improvement of objectives has been accompanied by changes in the microscope stand adapted to the demands made by the wide angled glasses and substage immersion illuminators.

It seems a good time to sum up these changes and to try to determine what ones of them will be of permanent value, and should form part of the features of the complete microscope stand. It may also be worth while to inquire whether experience has not developed certain requisites of a good stand in its mechanical arrangement and relation of parts which ought to be embodied in every instrument intended for real scientific use, and to which the old models ought to be made to conform.

1. *The Arm and the Fine Adjustment.*

The controversy between the advocates of the old Ross model and those of the Jackson arm, could not be said to be settled so long as the model with the screw for fine adjustment placed on top of the tube was the standard for the latter form. The advantages of the long-lever fine adjustment, which could be used with the rectangular jointed arm, were so well recognized that they pretty well balanced the greater steadiness and simpler mechanical arrangement of the Jackson model. The introduction of Zentmayer's improvement by which the fine adjustment screw was brought back to its proper place below the body of the instrument, with the long lever moving the whole body, but not interfering with the actual length of tube in the adjustment, was almost at once recognized as a positive and valuable improvement, bringing the working parts of both coarse and fine adjustment into convenient relation to each other, and into the position most favorable to the comfort of the microscopist, least fatiguing to his arms, and most conducive to delicate and steady focussing in nice work. Since it also combines with these advantages, all the superiority of the Jackson model, it must be regarded as fixing, for some time to come, a most desirable feature, if not a necessary requisite, of a first class instrument. Similar results have been reached by the ingenuity of several makers of instruments the essential characteristic being the strong and simple arm with a reliable and delicate fine adjustment conveniently located, and free from the objections to the old method of depending upon a spiral spring to carry the weight of the whole body.

2. *The Stage.*

That the stage should be as thin as practicable, and that it should revolve about the optical axis of the instrument, have been for several years settled points in construction. There are still found microscopical experts who discard the mechanical stage altogether, and many more who recognize the fact that for some uses, such as working over fluids, etc., the plain clean stage, unencumbered even by clips, is desirable. It would seem that the true solution will be found in having the circular rim of the stage thin enough to admit light of the obliquity of at least 70° from the axial line, but with the central plate of the stage removable, so that either a plain metallic circle with clips, a glass stage, or a thin mechanical stage may be used, or the one interchanged with the other at the choice of the owner. The circular rim of the stage would belong to what Ross used to call the *basis* for a complete instrument, and the forms of stage could all be adapted to it. Nearly every microscopist has work to do for which the mechanical stage is almost indispensable. Micrometric measurements, especially with cob-web micrometer, are notably of this class. So is the work of systematic sweeping of a slide to make sure that every part of it has been examined: no amount of tactile skill can make one quite sure that each swath across the field has been regularly cut, without the aid of an accurate mechanical stage. The mechanical stage is likely therefore to be the standard, whilst the other forms should be made for instant exchange with it.

In connection with the stage, some devices have been furnished which do *not* seem to be worth their cost, especially as they interfere more or less with the needed and most important feature, thinness of stage. First of these is the rack and pinion movement for revolving the stage: this is work the fingers can do better than machinery. Second is the centering adjustment for the stage itself. In instruments specially constructed for goniometry, this device is useful; but most microscopists will prefer the things which must be sacrificed to it, viz., thinness and simplicity. It must be remembered that no two objectives are centered exactly alike. If you are using a double nose-piece for the sake of having two different powers at command, you will find that the same centering of stage will not answer for both. But, without the nose-piece, the same thing is noticeable when the objective is changed. The centering devices for the principal stage must, therefore, be put among the peculiarities of instruments for special uses, and not a part of the general standard.

But the recently invented plans for reversing the stage have quite another importance. The occasional use of light of extreme obliquity, upon dry mounts, and from the mirror alone, is part of every microscopist's experience. In nearly every department of natural science there will be need of this, and it is a mistake to suppose that it is only the diatomist who wants it. The superiority of wide-angled glasses for all sorts of work is getting to be so largely accepted, that everybody who has a microscope will wish to be able to test his or his friends' glasses, if only for the purpose of investigating this claim. The complete instrument should therefore have an easily reversible stage, so that the slide may be clamped next the mirror, and light used upon it up to the very verge of 90° from axis. The extreme obliquity of dry light could thus be got, whilst the stage in ordinary position would give all the angle needed for immersion illumination.

This requisite of reversibility for the stage is, however, subject to the contingency that we may grow into the habit of using the immersion illuminator and condenser for dry mounts, as well as those in balsam. There seems to be no theoretic objection to doing this, and the tests I have made sustain the practical usefulness of the method. The obliquity of the illuminating beam is measured by the angle at which it falls upon the object, and consequently by the angle at which it leaves the upper surface of the slide. But in dry mounts the beam most nearly approaching 180° cannot have had a direction within the glass of the slide, more oblique than half the critical angle, 83°. Consequently, if by means of the immersion prism, traverse lens, or Wenham half-button, we send a beam of light of about 40° obliquity straight through the illuminator and slide, the only refraction will be at the upper surface of the slide which it must leave (and impinge on the object mounted on the cover glass) at an angle closely approximating 90° from the optical axis of the instrument.

If no serious objection is found to this use of homogeneous illumination in practical work, all need of reversing the stage will be overcome, and still another step in the direction of simplicity will have been taken.

3. *The Sub-Stage and Mirror Bar.*

The swinging of the mirror bar on the optical centre of the instrument is one of the positive improvements. The swinging of the sub-stage is of very doubtful use. By swinging the mirror bar in the new manner several real advantages are gained. First, the mirror is kept at its proper focal distance from the object. Second, it may be swung above the stage for illumination of opaque objects. Third, it allows the instrument to be used for measuring aperture of object glasses, by converting it into Prof. H. L. Smith's 'Universal Apertometer.' But when we ask for the advantages of swinging the sub-stage with illuminating apparatus, it is difficult to find them. It is plain that we don't want to swing the polariscope, the parabola, the dark wells, the Webster condenser, the wide angled achromatic condenser, or the immersion illuminators, and could not if we would, for the form and mounting of these accessories is inconsistent with doing so. The question must practically be narrowed to the desirability of swinging the diaphragm and the low angled achromatic condenser. Of course none of the flat diaphragms can be swung in the manner we are speaking of, and no advantage seems to be found in the use of the sharp nosed diaphragms with oblique light. The fact is that there are advantages in taking oblique light directly from the mirror; for the chromatic fringes at the margin of the illumination often enable the microscopist to modify the light in a way to get increased resolution by turning the mirror so as to take the most lateral rays and those nearest the blue end of the spectrum. More range in quality of illumination can be gotten by the practiced hand in this way than by the oblique use of the diaphragm.

In the use of an achromatic condenser, it must be a very low angle indeed which will work far enough from the bottom of the stage to allow much swinging to right or left, especially when we take into account the fact that the centering of the substage becomes more important when it is swung away from the axis of the instrument.

The centering arrangement of the substage will occupy so much lateral room that it can be swung but a little way before striking the stage. Again, any achromatic condenser of even moderate angle can be swung very little to right or left before its marginal rays will become parallel to the bottom of the slide containing the object under examination, and they then, of course cease to penetrate to the object or be of use for illumination. Still, again, experience seems to prove very conclusively that the most effective as well as the simplest arrangement for securing oblique light (otherwise than from the mirror alone) is by the prism, the traverse lens, the Wenham 'half button,' or other immersion sub-stage illuminators. These considerations lead strongly to the conclusion that the swinging of the sub-stage is useless.

If sub-stage and mirror bar swing together, it will necessitate fastening the immersion illuminators to the bottom of the stage by some special means, such as bayonet catch, screw in the stage well, etc., thus doing the very things the sub-stage was designed to avoid, viz.: encumbering the principal stage with attachments for apparatus. If you attach a part in that way you may as well attach the whole, and do away with sub-stage altogether. The proper line of improvement is to make the sub-stage do all its proper work, and keep the principal stage thin, clear, and unencumbered.

Let us see how this may be done. First, the sub-stage bar should be immovable, in the axis of the instrument, the mirror bar swinging under it and upon the optical centre. Second, the diaphragm should be of some pattern equivalent to the iris form invented by Geo. Wale, with spherical or tapering nose, so that it can be racked up close to the bottom of the slide, and be capable of contracting to a pin hole. Third, the sub-stage should be furnished with centering screws: this is as important when using the pin-hole diaphragm as it is with a wide angled achromatic condenser. What has been said above of the differences of centering in objectives, or (what produces the same result) the differences in the cutting of the screw thread on objectives, shows that no permanent centering of stage or sub-stage will answer. The centering of the sub-stage is really important, and should be always at command. Fourth, the base of the sub-stage to which the rack and pinion movement is attached, should be separable from the upper part; the latter should slide out from the base by a perpendicular dovetail. The object of this suggested arrangement is to allow a fitting to be attached to the sub-stage base, in place of the sub-stage itself, which shall carry the immersion illuminators (which do not need accurate centering) and which may work so close to the principal stage as not to intercept from the mirror the light of the lamp when in its ordinary position, which the sub-stage is sure to do if the mirror bar is swung off for the purpose of throwing oblique light through the prism or other immersion illuminator. If a dovetail slot be cut both in front and back of the separate base for sub-stage, the prism or traverse lens carrier may be fitted to the forward one, and the rear one may carry a graduated semicircle or quadrant to measure the angle of obliquity to which the mirror is swung. These suggestions are illustrated in the accompanying figures, the form adopted for the prism or traverse lens carrier being one which the writer has found practically useful in holding the prism or half-button in such a position as to allow the use of light of any degree of obliquity as well as directly central illumination. In short, the rack and pinion movement at the base of the sub-stage must be made to carry *all* the sub-stage illuminating apparatus, and not merely a part of it.

The mirror bar itself should have a sliding extension which should lengthen the bar so as to increase the distance between the mirror and the stage without changing the angle of incident light. This is often useful and sometimes necessary when the bulls-eye condenser is not at hand, or circumstances compel the use of a lamp further removed from the mirror than common. The divergent rays direct from a lamp may be thus condensed upon the object with as good effect, even in delicate tests, as if the bulls-eye were used to parallel the rays when the concave mirror is kept at its usual distance from the stage.

4. *The Base of the Stand.*

The base of the stand should be such a modification of the tripod as shall allow the mirror bar to be swung freely when the instrument body is perpendicular, so that the use of oblique light may be had when the microscope is in that position. The advantage of this has recently been recognized by the Messrs. Ross, who have changed the form of the base of their first-class instruments to meet this requirement.

In this review of the requisites of a stand for general work, nothing has been insisted on as the "basis" of a complete stand, which is more costly or more difficult of construction than makers of microscopes have already offered to the public in the form of Student's stands. There is no good reason why a Student's stand should be made in a less useful form when one more useful will cost no more to the manufacturer. Even trade is not benefited by selling to the young investigator or the poor professional man an instrument which he must discard as soon as he feels a desire to do better work than a beginner's. The possession of a good "basis" for a complete instrument will lead the owner to add to it the improvements and the accessories which will make his instrument all that he needs or desires, when this does not imply beginning anew with the loss of all invested, but only the addition from time to time of a moderate sum. Even in a mercantile view, the manufacturer will no doubt find his account in this. The publication of the history of recent improvements in the microscope stand which appeared in a late number of the *Journal of the Royal Microscopical Society*, seems to show that whatever may be the merit of different opticians in popularizing some of the devices, the invention of them is rarely the exclusive property of any. We are not arguing in support of anybody's patents, therefore, in pointing out the desirable features of a microscope stand in the present state of the manufacture.

Let us summarize, then, the qualities which have thus been found requisite to the proper 'basis' of a complete stand, and which ought to be found in every 'Student's stand' as well.

1. A firm and rigid arm having the general character of the Jackson model, carrying the body of the instrument, with coarse and fine adjustments conveniently placed below the body, with perfectly even and reliable motion.

2. A firm ring as the base of the stage, to which any form of stage plate, plain or mechanical, may fit.

3. The stage in either form thin enough to allow the use of light of at least 70° obliquity from the axis of the instrument.

4. A grooved bar for the support of the sub-stage, which may or may not be fitted with rack and pinion movement. No illuminating apparatus to be attached to the bottom of the stage proper.

5. The mirror bar to swing on the optical centre of the instrument above as well as below the stage, and to have a sliding extension.

6. Such form of base as will permit the mirror to be swung laterally when the instrument is in upright position.

These essential requisites leave the form and elaboration of the stage and sub-stage to the choice of the purchaser, as well as the extent to which accessories shall be indulged in. They also leave room for variation in the size and finish of the instrument, though no instrument should be so small as not to have room for sub-stage apparatus, nor should the finish be anything but first-class in all the movements, adjustments and joints.

Nearly every form of stand now sold by makers of reputation could be made to conform to the above requirements with very trifling alterations in pattern, retaining enough that is distinctive to mark the work of each optician. It would also be an advantage if the accessories and sub-stage fittings could be made upon an agreed gauge, or at most upon two; one for the largest stands, and another for the so-called 'Student's' or second-class instruments. This is accomplished in achromatic condensers, etc., by having them fitted with the Society screw, by means of which they are readily used with an adapter upon any sub-stage; but the principle should be carried further, and the accessories all made on interchangeable guages. If microscopical societies and conventions would seriously take in hand the task of bringing about this uniformity in essentials, it would soon be accomplished. Two standard sizes would, perhaps, be necessary for such accessories as the polarizer, but it may be doubted if the greatest advantage will not be found in insisting upon a single gauge for all sub-stage fittings. There are good reasons why

Fig. 3.

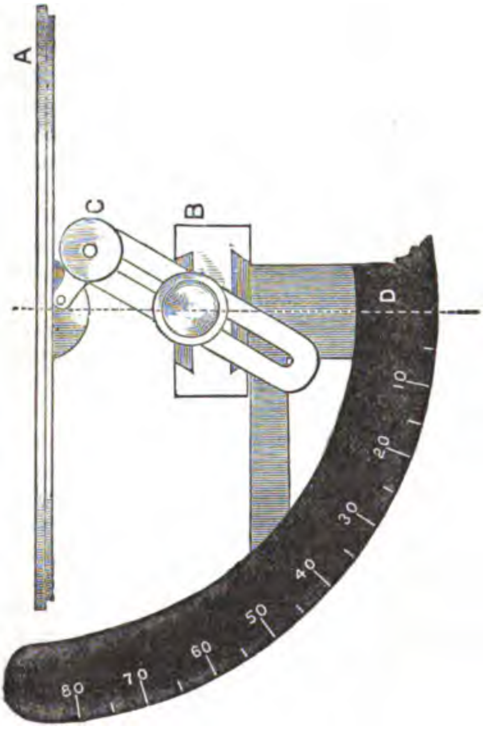


Fig. 2.

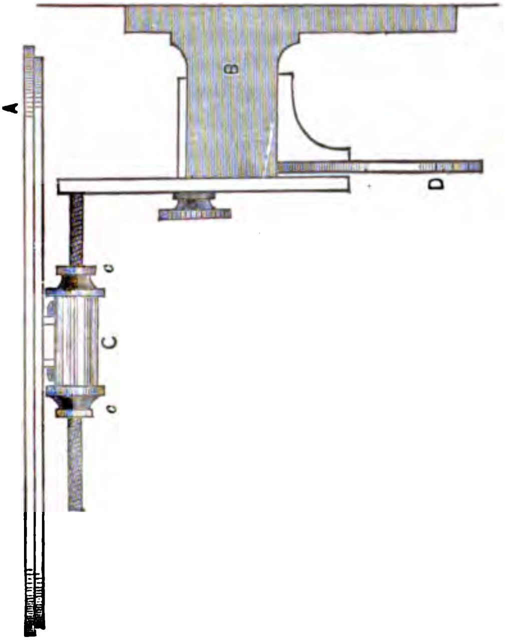


Fig. 1.

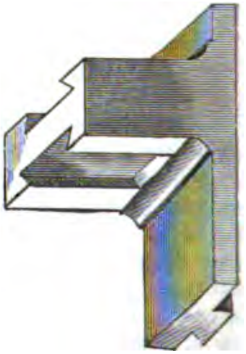
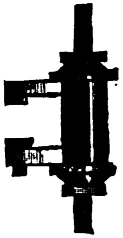


Fig. 4.



STAGE AND SUB-STAGE DETAILS.

small and compact, as well as large and roomy stands, should be desired, and this will involve the need of two gauges of tube and of oculars, and two sizes of stage; further than this there would seem to be no need of diversity.

EXPLANATION OF FIGURES.

Fig. 1. Shows the form of the sub-stage carrier, with dove-tail slots into which the ordinary sub-stage centering rings or other accessories may be slid.

Fig. 2. The lateral view of the stage, A; the sub-stage carrier B; the carrier for the prism, etc., C, and the quadrant D, in place. *c* and *c* are set screws clamping the vise C.

Fig. 3. The vertical view of same, showing the vise clamped by the set screws in such position as to allow of either central or oblique light.

Fig. 4. The vise for holding prism, etc. The jaws and body of the vise are in one piece, and the prism or "half-button" is clamped by the small screw which passes through the upper jaw.

A Sequel to Abnormal Entozoa in Man.*

BY REV. SAMUEL LOCKWOOD, PH.D.

SUNDRY reasons seem to require a few corrections and additions to my paper on "Abnormal Entozoa in Man," read before this Society, at its meeting, in November last. When preparing that paper, my health was such as to forbid much book research. Moreover, my specimen of *Mermis*, and the letter from the donor, were mislaid. Since then, both have been found. I should also add that the publication of the paper has been followed by some instructive correspondence with men eminent in a kindred line of work.

Here is that specimen of *Mermis albicans*, The letter says the writer found it in the core of an apple which he was eating, at Unionville, Orange Co., N. Y. It is dated Oct. 13, 1873, not 1876, as appeared in my article. The donor states that before being put in spirits, it was "white as snow." It soon changed to a cinnamon brown. I should mention here, that in vol. vii, *Popular Science Monthly*, for 1875, p. 506, is a note saying that I had exhibited a specimen of *Mermis acuminata* to a quasi-scientific body, met in Rutger's College. This is that specimen, and to it I gave Leidy's name *acuminata*, which, however, upon better knowledge, I have since assigned to *M. albicans*. The latter fact called forth from a learned naturalist an adverse, though private and kind, criticism; whereas Mr. Lintner, the accomplished State Entomologist of New York, writes me: "In assigning your species to *albicans*, you are up to the last hour of science." It is true that Leidy supposing he was dealing with a new species, named it *acuminata*. This was in 1875, and he says his specimen was a female, and "parasitic in the larva of the Codling-moth, *Carpocapsa pomonella*." As to the sex, farther on it will appear that it was an error, as the entire species at that stage are sexless. In Hayden's Ninth Annual report, Packard gives the American species of Mermis: *M. elongata*, Leidy; *M. crassicaudata*, Leidy; and *M. acuminata*, Leidy. In the first joint report of the United States Entomological Commission, (pp. 333, 334), of which Packard is a member, it appears that Siebold had named the species found in *C. pomonella*, *acuminata*, but that now he regards the name as simply indicating a certain larval stage in all the species; for, "from the studies of [Siebold] Diessing, Meissner, and others, it has been concluded that *M. albicans* is but the mature sexual form of *M. acuminata*, which is the asexual form of [all] the species."

It is now known beyond all doubt, that the larvæ of *Mermis albicans*, both here and in Europe, enters the larvæ of the Codling or apple moth. Thus the caterpillar takes its entozoon with it into the apple—and if this does not explain that royal mystery, how the apple got into the dumpling, it does clear up the entomological query, how albicans got into the apple. The mermis at this stage has no mouth, nor anal duct, nor alimentary canal. It lives, and grows within its host, which it consumes by endosmose absorption simply, the guest using up its host, much as some bipedal sponges do. Leaving the apple it enters the ground an asexual individual. A fatty mass becomes developed into those parts which make the sexual differences. The two sexes unite in the wet ground, the pair looking as if tied, perhaps in a lover's knot. The female lays her eggs in the same place. The larvæ seek out insect grubs in the ground, or even at the surface, into which they enter. The point of mystery still is how this little Mermis worm gets at the Codling caterpillar. The same difficulty, however, obtains with the Gordius, or Hair-worm, which is sometimes found in the katydids, seeing that both katydid and Codling, are arboreal beings; but our *Mermis albicans* "is of the earth, earthy." Its life career begins in the ground, and Siebold suggests that the young worm may on wet days climb the trunks of trees, and falling in with the young caterpillar about boring the apple, it there and then, bores the little Codling as an unwelcome guest. Of course, this is opinion, but from Siebold it is entitled to weight, since this able zoologist conducted, with much patience and skill, a series of experiments to determine some habits of the larval Mermes when seeking their insect hosts.

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* Read before the New Jersey State Microscopical Society, March 21, 1881.

As to Gordius, the Hair-worm, Diessing says, that a girl in Ohio passed *per anum G. varians.* In Europe the belief is general that they enter man with the water which he drinks. We think it not unlikely, that *Mermis* sometimes enters man with his food. Hence, may be adduced two important considerations. Gordius, when in a fertile state, lives in the water chiefly. Herein lies the danger to man, and other animals.

Mermis, when occupying insects or fruit, is asexual, and is only fertile in the wet ground, in which state it is hardly probable that it could enter by accident either man or beast.

In the paper to which this is an appendix, I referred to a specimen of that pygmean fish, the Ten-spined Stickleback, *Pygosteus occidentalis.* I have here drawings, exact life-size.

Fig. 1 is a portrait of the fish, showing the belly distended by the presence of larval Gordius, or Hair-worm within. Fig. 2, shows the worm as it was in a snarl or ball in the fish. Fig. 3, shows the same when uncoiled. I have here under the microscope, mounted in a cell of glycerine, the pretty fan-like tail of the fish. It will aid to a conception of the small size of the animal. But it has another interest, which decided my making the mount, which is now some seven years old—the tail fin is attacked by the aquatic fungus *Saprolegnea,* the cause of a destructive disease among fishes.

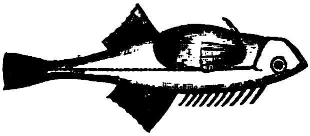

Fig. 1.

Fig. 2.

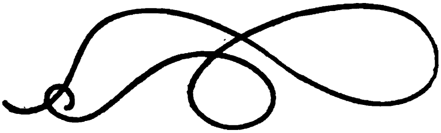

Fig. 3.

Referring to the larvæ of the Anthomyia, or Flower-flies, which were discussed in the former article, and which, as stated, were voided by a teacher, it might be asked—what about this change of food, and appetency; for these grubs were really vegetal feeders, but in their new habitats, they must feed on an altered and mixed diet? Perhaps we are but just beginning to observe correctly on these matters. Rily gives instances where the *Anthomyia,* or Flower-fly, lays her eggs in the nidus of the Rocky Mountain locust, that is, the grasshopper, *Caloptenus spretus,* and the grubs suck out the juices of the locust eggs. Surely this is encroaching on animal food. Yet Rily contends that this is but a variety of *A. radicans,* the radish-fly, whose larvæ, by feeding on this esculent, make it worthless for man, and he assigns to this devourer of locust eggs, the name, *Anthomyia radicans*, Var. *Caloptena.*

In the article which we are now supplementing, I stated that an undoubted American instance of a beetle entozoan was not known to me. We can now pick up "the missing link." Under this microscope is an interesting specimen presented by our fellow member, Dr. Shannon, to whom it was given by the mother of his patient, a girl suffering with diphtheria in New Brunswick, N. J. The child ejected it from the mouth by coughing a few days ago. Alas, it is but fragmentary, for only a portion of the anterior part is here. The mandibles are quite distinct, and really formidable. It is clearly a coleopteran larva, and is quite suggestive of the larvæ of the minute beetles, *Bembidium* and *Cillenum.* "These," says Packard, "are found abundantly under the refuse of freshets, and tides, preying upon dead animal matter, and (living) insects," Hence it may have been taken with food in a cooked condition, or in some other accidental way it could be taken living, as if fish accompanied with shore debris, should have been in contact with fruit or other vegetables, at the store, or at home.

We have medical authority for a number of instances of so called "larvæ of *Oestrus humanis*," having been found in the human stomach. I do not myself believe in such a species, as a human bot-fly. If those larvæ were true Oestridæ, they have been adventitious, and the eggs were accidentally swallowed from contact with some domestic animal.

It is profoundly interesting to know that the larvæ of such aerial, sunlight-loving creatures as the diptera, can live and attain the pupa state as accidental parasites in the human alimentary canal. Could this continue for a few consecutive generations, I doubt not that there would be a fetch-up in a decided degradation in the direction of well marked pseudelminths. What opulence of organs, and functional capacity do we not observe in the higher grades of insects! Here we should find a steady impoverisation of this organic affluence. Confined to that busy dismal laboratory, the digestive tract of their animal host, with its acid, and heat, and mucous slime, and darkness, it is sure that organic reduction would rapidly set in, and they would soon become eyeless, wingless, and footless, as the first stage of change. Take even an ectozoon, or external parasite, and is it not indisputably a morphological pariah in its own class? *Pedicula,* the body louse, is a wingless hemipteran, hence, is true cousin to cicada, the great harvest-fly; and *Melophaga* the bird mite, and *Pulex,* the flea, are real diptera, and although wingless are true cousins to the flies—of so noble a stirp were their ancestors; but established as parasites they are reduced to these degraded forms. There seems really a parallelism in the lines of movement of the material, and the moral forces, for whether in the domain of the physical, or the moral, parasitism gravitates toward degradation.

Should any desire to read on the Gordiaceæ, which embraces the genera Gordius and Mermis, the following sources are accessible.

1—The Gordius, or Hair-worm. By Prof. Joseph Leidy. May, 1870. *American Entomologist,* vol. ii, p. 193.

2—*Gordius and Mermis.* By Dr. Packard, Hayden Annual Report, Geol. and Geog. Survey of the Territories, for 1875, pp. 662–667.

3—*On Mermis Acuminata.* Leidy. Entomological Contributions, No. IV., Art, i. By J. A. Lintner. Albany, N. Y. 1876.

4—First Report of the United States Entomol. Com. for 1877, pp. 326–334. Gordius and Mermis.

5—For interesting Experiments with larvæ of Mermis, see "On Tape and Cystic Worms. By Carl Theodor Von Siebold. Translated by J. H. Huxley." In Kuchenmeister's Manual of Parasites, vol. ii, Sydenham Society's Pub's., pp. 8–12.

6—Entozoa. By Cobbold. 1864. London. See Family II, Gordiidæ.

NOTE.—Since this paper was read, a specimen has been submitted to me by Dr.

Ephraim Cutter, received from Houston, Fla., where it was obtained from the fæcal discharge of a woman. It reached me dead, and proved to be a dipteran grub, of the family *Muscidæ*.

Death of Nobert.

WE regret to learn that F. A. Nobert, the producer of the famous "Nobert Plates," has died. Those who possess plates ruled by this famous mechanician will now prize them very highly.

A New Microscopical Journal.

WE have just received the first number of *The Microscope*, a journal established at Ann Arbor, Michigan, by Prof. Charles H. Stowell and Mrs. Louisa Reed Stowell. The new journal is specially devoted to Medicine and Pharmacy, is well illustrated and carefully edited. It fills a sphere of its own, and should be in the hands of every physician and druggist in the country. Both editors have a practical acquaintance with microscopy, and the results of their experience cannot fail to be valuable to all workers. We had marked a short article by Mrs. Stowell for republication, but find that we have already in type several more pages of matter than we can use this month, so we will have to hold it over till our next number.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Illumination of Blood-Discs.

Ed. Am. Jour. Microscopy—In the last number of your journal I notice a communication signed "An Old Plodder" in which the author questions the correctness of the figures of blood corpuscles in my Compendium. I would state that the cut was not intended to give a picture of blood corpuscles, but only to give the beginner an idea by means of a diagram what he should aim at in illuminating his microscope. Even if I had intended to give a correct figure of the morphological elements of the blood, I would have failed as all others have done who have attempted to represent blood corpuscles by means of a wood cut, either in lines or in stippling. According to my idea, Stricker's figure is as incorrect as my own, for it is impossible to reproduce the gradual shading of tint from the dark and well defined margin of the discs to the slightly tinted centre. There can be no doubt that the outline of the side view of the blood discs, as Stricker has figured it, is correct, and that with high powers, even under the most favorable conditions we cannot resolve the margin of the blood corpuscles into an absolute line, but this may be very closely approached. I send you four photographs which represent the four figures in my book, and you will see that the outline of the discs in the centre of Fig. 1, very nearly approaches a line. If you can reproduce these photographs in your journal in any way I shall be very glad, for I have failed to obtain satisfactory cuts, and had to content myself with the diagramatic cuts given. CARL SEILER, M.D.

Philadelphia, April 16, 1881.

Simple Form of Weber Cell.

Ed. Am. Jour. Microscopy—A cheap variation upon the Weber growing cell may be made, by cementing a thick glass circle (or two or more thinner ones cemented face to face) of ½ inch in diameter or less, to the centre of an ordinary slip with balsam. About this and concentric with it, cement a tin ring of at least ¾ in. inner diameter, its thickness to be very slightly in excess of that of the circle. Place the drop to be examined on the circle, grease the ring and over all drop a 7-8 inch cover. This will furnish a sealed cell, a film of the liquid under examination, and plenty of air. C. VAN NORDEN.

St. Albans, Vermont, April 4, 1881.

Questions in Optics.

Ed. Am. Jour. Microscopy—Will some of your correspondents, versed in physics, give the answers to the following questions in optics: Given a plate of crown glass, refractive index, 1·525, with parallel surfaces, a ray of light, medium of the solar spectrum, incident on the under surface at 45° from the normal, what will be the direction of the ray in the glass?

What will be its direction of emergence in air?

What will be its direction of emergence in water?

What proportion of light will be reflected from the under surface of plate?

What proportion will be reflected from the interior upper surface?

If the incident light is 38°, answer all the above questions. CARL REDDOTS.

Effect of Angle of Aperture.

Ed. Am. Jour. Microscopy—It is now about four and a half years since I began working with a French triplet. The period is not *long* since then, but I have been *assiduous* in search after knowledge in microscopy, working portions of these years day after day and night after night, with glasses of various angles, from 15° to an inner angle in excess of 100°—working with such kind of material as I could find in Nature around me, or gather by exchange from other parts of our globe. I will say that if J. E. Smith has discovered any principle (or call it law) in optics, or any phenomenon through his tubes, that will warrant him in recommending one glass with an aperture of 40° as first-class, and another of 40° as fit only for a "hack," on the ground that one has a focal length of 1 inch, and the other of ⅛ inch, his experience has been very different from mine. Furthermore, if he has discovered such a thing, he has dealt the death blow to the dogma of Angle of Aperture; for if this be so, we do not see by virture of A, A, but *by virtue of focal length*, nay! *we see in inverse ratio to the magnifying power of the glass* if we accept all that J. E. Smith seems to imply.

If the dogma of Angle of Aperture means anything, it means that a *given amount of light will produce a given effect.* In this sense I accept it. A cone of light having an angle of 40° is a fixed mathematical fact. If such a cone of rays passing through a lens will show 30,000 lines to the inch it must give the same result passing through any lens equally well corrected, *if the environment is the same.* Are these things so? or are they not? If so, is it not *nonsense* to laud one glass of 40° because it has a focal length of 1 inch, and stigmatise another of 40° because it has a focal length of ⅛ inch? If I am wrong, then I cannot get right by pursuing the road I am on; so I will thank any one who will be so kind as to show me the error of my way.

C. O.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Oneida Microscopical Society.—A regular monthly meeting of this society was held in its rooms, March 28th. The paper of the evening was read by Mr. Mallory. Subject: "The Selection of a Microscope." The reader commenced by saying that to recommend the stand of any one maker to the exclusion of others, would be a most difficult and thankless task, not only because of the slight difference in point of excellence between the stands of first-class makers, but also by reason of the new forms of stands yearly designed for special investigations. Then followed a series of hints on the selection of a stand in which every essential was embraced. Regarding mechanical rotating and glass stages, they were stated to be conveniences, not necessities. Of the four forms of coarse adjustment in use, chain, friction, sliding tube, and rack and pinion, the latter was advised as the best. The sliding tube the writer considered a relic of the barbarous ages, a fine adjustment moving the entire body was to be preferred to any other form. In regard to objectives, it was in the opinion of the reader, the best economy to buy first-class objectives at the outset. In conclusion, Mr. Mallory advised to buy only the best when you do buy, and take good care of it when you have bought it. An animated discussion took place at the close of the paper. Rev. Mr. Whitfield, a manufacturer of optical instruments, made a few interesting remarks regarding objectives, and also spoke of a very ingenious stand he had seen at Troy, made entirely of paper and wood. He also described a coarse adjustment he had seen at Mr. Tolles, in Boston, consisting of two pinions with V-shaped peripherys, at a short distance apart on the same spindle working into two V-shaped grooves. The motion communicated, was very delicate, and uniform. The speaker had never seen this adjustment on any stand in the market. Dr. Deecke, of the State Lunatic Asylum, described the large stand now used by him at the Asylum, which was furnished with double rack and pinion, he claimed entire freedom from lost motion, and great ease of movement from this arrangement. Prof. Chester gave a brief description of the most desirable instruments of low price now in the market, mentioning the following instruments as excellent in quality and reasonable in price: The New Working Microscope, Bulloch's Histological. The Acme, Bausch & Lomb's Students', Investigator, and Library, and Beck's Economic and New National Stands. A vote of thanks was tendered to Mr. W. H. Walmsley, of Philadelphia, for a gift of five of his unsurpassed mounted objects, which, in the words of the donor, are intended as the nucleus of a Cabinet. Dr. Deecke was appointed to read the next paper before the society.

GEORGE C. HODGES, Secy.

Iowa State Medical Society—Microscopical Section.—At the late meeting of the Iowa State Medical Society, a Section of Microscopy was formed, with the understanding that if a sufficient number of persons interested in microscopy, who are not medical men, should become interested in the matter to justify the organization of an independent society, then the Section of Microscopy would resolve itself into an independent society.

The next meeting of the Iowa State Medical Society will be held in Dubuque, commencing on the last Wednesday in May, 1881, at 10 o'clock.

All persons interested in microscopy, whether medical men or not, are hereby invited to come and bring their microscopes, etc., with them.

Many men throughout the State have microscopes, but, not considering themselves microscopists, may leave their instruments at home. We are all novices in the work, but are trying to cultivate an interest in microscopy. Bring what you have. We wish to have all the microscopes we can possibly collect. Come and help us show the scientific world that Iowa yet lives. J. J. M. Angear, President, Fort Madison, Iowa; W. D. Middleton, Secretary, Davenport, Iowa.

Microscopical Society of Liverpool.—The fourth ordinary meeting of the Thirteenth Session of this society was held at the Royal Institute on Friday, April 1st, 1881, Dr. Carter, President, in the chair.

The Hon. Secretary, I. C. Thompson, announced the donations of Twelve Microscopic slides from A. C. Cole, Esq., London, Hon. Member, and the Journal of the Quekett Club, from the Club. One new member was elected, and two gentlemen were nominated for election.

The President then called upon Mr. Mayall, Jr., F.R.M.S., for his communication on "Brass and Glass." Mr. Mayall said it might be in the recollection of many then present, that about a year ago he had the honor of addressing a few remarks to the Society on the subject of immersion objectives, with particular reference to the increase of aperture which the immersion system developed over the maximum apertures of dry objectives. The remarks he had then made appeared to have produced an impression on the Hon. Secretary of the Society, and at the conclusion of the meeting that Hon. Secretary, with a zeal peculiar to the energetic race of Hon. Secretaries, pressed him to promise a more detailed exposition of his views on aperture and matters relating thereto. In fulfilment of the promise then extracted from him, Mr. Mayall said he had come to Liverpool, not, however, with a formal paper on the subject, but with the intention of giving a few illustrations in popular form which might fittingly be given under the heading of "Brass and Glass." By "Brass and Glass," must be understood that part of microscopy concerned with the development of the microscope as an instrument apart from its application to this or that special branch of study.

Mr. Mayall said that it had recently been, most ungenerously stated in public that the "Brass and Glass" party among the microscopists, cared for nothing but mere display of elaborate apparatus, that they vied with each other in encouraging the manufacture of more and more expensive instruments for the gratification of their personal whims and fancies, and without the slightest reference to advancing any scientific branch of microscopy. It was no part of his programme to explain in detail what exactly was expected to be gained by encouraging opticians to construct stands, objectives, condensers, etc., which, from their elaboration, must necessarily be costly, but might point generally to the fact that the most conspicuous developments in recent microscopy—particularly the delineation of microscopic objects by means of microphotography—were absolutely dependant on the perfection of the instrument. How the improvement of the instrument itself, was by no means so "petty" a subject as it had been sought to insinuate. He (Mr. Mayall) thought that a thorough investigation of the principles upon which the improvement of the instrument depended, was, by no means an unworthy or idle task; and he thought that if those principles were more generally appreciated, much more rapid strides would be made, and certainly there would be far less publicity given to crude and erroneous interpretation, the ground, would, in fact, be cleared of much mere controversial verbiage. Taking as an example the prevalence of erroneous views with regard to the meaning and function of aperture—he would endeavor to give to the meeting a clear statement of the old theory of this matter, and meet it, point for point, by the newer views of which Professor Abbe, of the University of Jena, was the originator. Then by means of a large number of diagrams, which he drew on the blackboard, illustrating his subject, Mr. Mayall dealt at considerable length on the main features of what he termed the "Aperture Controversy," concluding his remarks on that branch by an earnest appeal to all present, if they had any difficulties to suggest, to suggest them forthwith, as it was the ardent desire of himself and those with whom he was associated in the controversy, to have every point of difference thoroughly explained, their sole motive being the promulgation of accurate views. Mr. Mayall also exhibited and described in detail several specimens of "Brass and Glass," some of which he commended to the notice of the meeting whilst of others he said "the less said the better." Amongst the former were Tolles' Microscope with vertical disc, for the lateral rotation of the sub-stage with two stages of novel construction. Ross' Mechanical stage, Crouch's Students' Microscope with approximately frictionless fine adjustment, Parkes' Child's Portable Microscope, etc.

At its conclusion a vote of thanks was awarded to Mr. Mayall, and the meeting resolved itself into a conversazione.

New Jersey State Microscopical Society.—This society met on the 21st of March, in Rutgers College, New Brunswick, President Van Dyck, in the chair. Two new members were proposed. A paper was read by the President, as Part I. of an article on Angular Aperture. It was finely illustrated by well drawn diagrams on the black-board. The paper was noteworthy for its thoroughness and clearness, and will be followed by the next part at some future meeting. A sequel was read by Dr. Lockwood to his paper on Abnormal Entozoa in Man, published in this journal. He asked attention to the fact that this paper was republished from the AMERICAN JOURNAL OF MICROSCOPY in the *Virginia Medical Monthly*, and an introduction to it by Dr. Ephram Cutter, was read to the society. He showed specimens of *Mermis albicans* taken from an apple in 1873, at Unionville, N. Y. A fragment of a grub was shown, which was vomited by a girl, a diphtheritic patient at New Brunswick. The Secretary pronounced it the anterior portion of a minute coleopteran larva. The same gentleman showed, in a glycerine mount, the caudal fin of the pygmy fish, *pygosteus occidentalis*, the ten-spined stickleback—the fin being attacked by the disease due to the presence of the aquatic fungus Saprolegneæ.

A Student's microscope, by Geo. Wale, with one of his one-fifth objectives, was exhibited. Both instrument and lens showed capacity for very high-class work. This is the same instrument which was so favorably noticed by Dr. Carpenter at a meeting of microscopists in London. The Society felt justly proud of the superior work of their fellow member.

The Secretary exhibited Case 28, being the conclusion of the VII Century of the Typical Diatoms by Prof. Smith, of Hobart College. Dr. Lockwood said, he thought that in the name of Science the society could congratulate Prof. Smith, on the happy close of his great American work on the Diatomaceæ, as it was a monument to his genius and great labor in a delicate and difficult line of work. A copy of Leidy's Rhizopods was received as a generous donation from the Secretary of the Interior. S. LOCKWOOD, Secretary.

San Francisco Microscopical Society.—The regular semi-monthly meeting of the San Francisco Microscopical Society was held at their rooms on Thursday evening, March 3rd, with President Kinne in the Chair. The discussions of the previous meeting called out an attendance of members interested in the detection of forgeries, raised drafts, etc., and who were well repaid.

A large list of acquisitions to the library were handed in by the Corresponding Secretary, and the cabinet was added to by the donation of two finely-mounted slides of Santa Maria diatomaceous earth, prepared by the hands of Vice-President Norris, who is manifesting a fine manipulation in the old but fertile field of mounting and studying diatoms.

Somewhat in the nature of a reply to criticisms on a previous paper on "The Detection of Forgery by the Aid of the Compound Microscope," Dr. J. H. Wythe read the following paper on

GRAPHIOLOGY :

As the subject of forgery is one which so frequently claims the attention of our Courts of law, and as the microscope is so efficient a means of detection, everything which is pertinent to the subject becomes of importance. In a communication to the San Francisco Microscopical Society, last August, I quoted an article from the *Banker's Magazine*, calling attention to a "minute secondary rhythm caused by the action of the small muscles in regulating the amount of pressure upon the pen, which is imperceptible to the naked eye," and requires a compound microscope with a power of about ten diameters, and a careful illumination with a bulls-eye condenser, for its determination. My article added to the quotation some account of my personal investigations, and classified the various rhythms necessary to be observed by the microscopical expert, before pronouncing upon the question of genuineness, as follows :

First—The rhythm of form dependent on habit or organization.

Second—The rhythm of progress, or the involuntary rhythm, seem as a wavy line or irregular margin of the letters when well illuminated under the compound microscope and magnified ten diameters.

Third—The rhythm of pressure, or alternation of light and dark strokes.

These various rhythms should be examined, as well as the paper, ink, erasures, and the comparison of forms of letters. After considerable experience, I still maintain that "if the microscopist carefully observes these three rhythms, being careful of the illumination of the letters, he cannot fail to demonstrate the difference between a genuine and an imitated signature."

Since the presentation of my article, I have read some criticisms which remind me of the almost universal custom of neophytes, to whom we exhibit some interesting object in the microscope for the first time. Instead of attending to the object shown, they will almost universally look at some flaw on the cover glass, speck on the eye-piece, or accidental streak, and ask : "What is that dark spot?" Some of these criticisms show plainly that their writers fail utterly to comprehend the idea presented. One finds fault with the measurement of 200 to 300 in the inch given by the article in the *Banker's Magazine*, and declares that the irregularities are "without doubt caused by the uneven surfaces of the paper fabric assisted by capillary attraction." The proofs relied upon for this opinion are the uneven edges of an ink drop, or of a line drawn by a ruler. From this the conclusion is reached that "there are no regular nerve impulses perceptible." As to the number of the vibrations, I consider it a matter of but little importance whether there are six or six thousand. The point I endorse is that there is an irregularity in the line which amounts to a rhythm. The irregularity produced by absorption of ink by the paper is so obvious, and so obviously different from the rhythm of progress, that no practical microscopist would be in danger of confounding them, and the veriest tyro would need no reminder.

Another criticism in the January number of the AMERICAN JOURNAL OF MICROSCOPY is accompanied by a wood-cut of pen-strokes magnified forty diameters. An examination of this wood-cut will convince any one of the difference between the irregularities of linear progress and the absorption of the "paper fabric." Differences in the irregularities of the lines are also obvious in the wood-cut. If it had been magnified but ten times (as proposed) instead of forty, the rhythmical nature of the vibrations would have been more evident.

In my first paper it was stated that a voluntary attempt at forgery leads to an exaggeration, or an interruption of the rhythm. To the latter part of this statement, the last criticism referred to lends unwitting corroboration. If all my critics follow in this line, my position will be well established. He says: "The truth of the matter in this respect is, that upon examination of the writing of the expert forger under the microroope, we find the sides of the ink strokes much more even (less tremulous) than those of the one they are intended to imitate. Indeed, this is often one of the very means by which the fraud is detected." If this language means anything different from the following, from my own paper, I am unable to perceive it. "The regularity of this system is destroyed by a voluntary effort at imitation, and is somewhat interfered with, but not entirely broken, by mental excitement." An "expert forger" will destroy the rhythm of the impulses, rendering the line "less tremulous," or smoother; but a bungler, or one whose conscience interferes, will exaggerate the rhythm.

In my essay I sought to classify and so put upon a scientific basis facts relating to rhythms in handwriting, which any microscopist ought to be able to verify. On such a subject it would be absurd to seek for anything but absolute truth, however refined or difficult the search. Courteous criticism is therefore to be desired and not shunned. I desire this the more, as I am now considerably advanced in the preparation of a book on this special subject, which will place the mode of examination within the reach of all interested.

Dr. Wythe supplemented his reading by illustrations on the blackboard, and endeavored to make clear his position. Mr. Denison and others regretted that the Doctor had not brought with him samples of writing to demonstrate his theory, and the Doctor explained, by the statement that it could not be well demonstrated to a roomful of people, but it must be studied at home, where each could satisfy himself. The manifest desire, however, of all the members to have ocular demonstration of the hypothesis presented to those who claim to have some experience with the microscope, resulted in the promise of the Doctor that he would come prepared, at the next meeting of the Society, to substantiate his declarations by various specimens of handwriting, and test his theory on the same.

Mr. Hickox, one of the indefatigable workers in the Society, was then called to the front by President Kinne, who was armed with tests, carefully prepared by Secretaries Denison and Banks, to ascertain whether the microscope would reveal under his eyes and manipulation, which of several intersecting lines in ink were written first. While, of course, the test as to distinguishing such priority was hurried, and not to be taken as conclusive, had more time and better facility been permitted, the result was most gratifying to all the members, and no doubt to the genial expert.

After the decision was endorsed in each of a dozen or more specimens, the key was produced and revealed the fact that the deductions of Mr. Hickox were astonishingly accurate, which fact added to the reputation of the man and the utility of the microscope indefinitely determining the matter, though he stated that no doubt specimens could be prepared which would baffle any one to decide upon without question.

The very interesting and valuable meeting closed at a late hour, with adjournment to meet March 17th, when Dr. Wythe, and several important amendments to the by laws will claim the attention of the members. A little of the old leaven of investigation seems to be infusing itself among the members, which is gratifying to all.

The regular semi-monthly and adjourned annual meeting of the San Francisco Microscopical Society was held at the rooms, 120 Sutter street, March 17th, 1881, President Kinne in the Chair. Some additions were made to the library, and 12 finely-mounted slides of diatoms from Dr. Rae, of Sterling, Scotland, through E. Gentlemom, Esq., were received in exchange for diatomaceous earth, and added to the cabinet. The Corresponding Secretary was requested to thank the gentlemen for the donations.

Dr. Harkness presented a pamphlet containing a list of California fungi, being the first instalment of about 400 discovered during the past year by himself.

H. Barnard, Esq., of San Francisco, was proposed for resident membership, which proposition remains for consideration until next meeting, under the rules.

The Secretary, C. H. Denison, made a report of the state of the library and cabinet, showing some respectable additions to them, and making various suggestions for their improvement.

The Treasurer, George C. Hickox, reported upon the finances, showing a healthy condition of the treasury.

President C. Mason Kinne made the following

ANNUAL ADDRESS:

SAN FRANCISCO, February 3rd, 1881.

To the Officers and Members of the San Francisco Microscopical Society:—

GENTLEMEN: As it is one of the duties prescribed in our Constitution that the President of this Society shall make a report at the close of his term of office, pertaining to general matters of interest which have transpired during the the year, I, of course, would not be just to myself or the gentlemen who honored me with this position a year ago, did I not at least go through the form of making an annual address.

You, however, are too well aware of the fact that there has not been the amount of interest displayed in the many branches heretofore investigated and reported on from time to time by our members that should have animated us, and, therefore, the list of original papers and verbal communications show a marked falling off from previous years.

This can be and should be remedied during the coming year, and, if it is not, it is your own fault. To constantly fill the position of the all absorbing sponge, taking everything in but furnishing nothing, unless it be literally squeezed out, is not the place for members of this hitherto fertile Society to occupy. Most of you are capable of giving us ideas, and papers expressing them worthy of any Society, and all can do much more in this respect than they oftimes think they can.

Among the papers read before the Society during the past year I find first that of our valued member and ex-President, Mr. H. G. Hanks, on "Rusty Gold," which was filled with good hints and valuable deductions.

Mr. Hanks also read at one of our meetings one of Mr. Melville Attwood's very carefully prepared papers on the deductions he had made regarding the "Clays in the Comstock Lodes," and at another meeting Mr. Attwood read a paper on the "Impregnation of Portions of the Enclosing Rocks of the Belvidere Lode, Bodie, with Native Silver, Electrum and Cerargyrite." Mr. Attwood's papers, like those of Mr. Hanks, are always interesting and filled with information regarding the mineralogy of this Coast.

Our Vice-President, Mr. Wm. Norris, has on various occasions embodied the results of his investigations in the world of diatoms, in the form of papers on various deposits submitted to him for examination, more particularly those of the Napa and Santa Maria deposits of diatomaceous earths.

The discovery of the latter deposit, and which was brought before us through the kindness and liberality of a friend of science and the society, Mr. D. W. Grant, was, through the attention given specially to it by Mr. Norris, quite instrumental in gratifying the longings of many of our Eastern friends for a more thorough knowledge and a greater supply of the so-called Santa Monica deposit, but which is now considered as a waif of flotsam and jetsam, carried to the latter point in the ordinary course of Nature, from the immense deposits of Santa Maria and vicinity. Dr. J. H. Wythe read an elaborate paper before us on the "Detection of Forgeries by the Microscope," and which seems to have been given considerable attention by some brother scientists in the East, and like all new theories, has been assailed by those not holding like opinions.

Our Secretary, Mr. C. H. Denison, has also given us a valuable paper on "Graphiology," and the detection of forgery by the aid of the microscope. This ably written paper was filled with original ideas, and, supplemented by ocular demonstration, seemed to controvert many of the assertions of Dr. Wythe on the same subject.

Dr. S. M. Mouser has favored us with several papers on the matters submitted to him for investigation, though of late we have missed his aid in this respect.

Dr. Harkness, one of our most esteemed honorary members, has met with us from time to time, and by his presence and counsel, given us valuable aid in many important matters.

The Edwards' collection has been almost wholly overhauled and put in shape for systematic examination, and the close of another year ought to see this valuable adjunct to our possessions in perfect order.

Our contributions and acquisitions generally have been large and varied, as usual, and the Library, Cabinet and list of periodicals are greatly enriched by them; and the report of the Secretary will no doubt give the details that this general summary cannot, though I must not omit the mention of Professor H. L. Smith's valuable "Centuries of Diatoms," which have regularly come to hand.

Our Treasurer's report will show a good, healthy condition of affairs, I am informed, though perhaps not up to the balances of former years, but what is not possessed in coin is now in the rooms of the Society in the shape of books, slides and material.

We have had visitors at our meetings from many localities, and it is with pride that we can point to the fact that scientific gentlemen seek out the Society as worthy of a visit when in our midst.

Having given this brief statement of the condition of our Society, it now becomes my melancholy duty to formally announce, in compliance with our Constitution, the death of our esteemed fellow-member and co-worker, our late Treasurer, Mr. G. L. Murdoch, which occurred in November last. His prompt attendance and genial presence has been, and long will be, missed by every member. Dr. J. P. Whitney, another fellow member, also was called away by death in November last.

No annual reception of the Society was held the past year in this city; but in lieu thereof, the members of the Society tendered a reception, or microscopical seance, in August last, to the citizens of Oakland, who had long been desirous of such a gathering. Twenty-one microscopes were on the tables, and our members displayed on the stages many and varied interesting and instructive objects.

While the progress of the Society has not been as great as many of us could wish during the past year—gaining but few members, and lacking the attendance of those whose business and residence have prevented them from the ability of meeting with us as of yore—still the outlook is good, and, with careful attention to the publishing of our reports, I am confident that with the Board of Officers you will select to-night, and the renewed interest of our members, I can safely predict a fruitful season for the year 1881.

While this Society has aided in cultivating a greater interest in the pursuit of microscopical research, and created a desire in many to learn more of the hitherto unseen wonders of microscopic nature, it has also proven to ourselves and others that more can be done and learned by united effort and friendly discussions around the society table than to plod along silently and alone. The history of the society in the past year or two has shown the almost absolute necessity of regular, thorough and readable reports of our meetings in the press of this city and Eastern periodicals. The *Alta California* always has, and still is willing to give us every facility in this direction, and I sincerely trust that much care will be bestowed on this feature, as I am confident it has aided us greatly in the past.

Permit me, in concluding this very brief address, to again thank you for the honor you saw fit to confer on me a year ago, by your selection of one as President, who has proven so unable to be present at your meetings, and to tender the thanks of the Society to the other officers for the work performed by them, knowing that such labors of love are fully appreciated. Very respectfully,

C. Mason Kinne, President.

The regular meeting then adjourned, and the adjourned annual meeting was called to order and immediately went into the

ELECTION OF OFFICERS.

President C. Mason Kinne was re-elected, but owing to the expectation of absence from town, declined the honor with thanks. Vice-President William Norris was then chosen President, but in consequence of reasons explained to the satisfaction of the Society, begged to be excused. The following officers were then balloted for and elected for the ensuing year: President, Samuel W. Dennis, M.D.; Vice-President, William Norris, (re-elected); Secretary, Charles H. Denison, (re-elected); Corresponding Secretary, Charles W. Banks, (re-elected); Treasurer, George C. Hickox, (re-elected).

The retiring President then introduced Dr. Dennis to the Society, who, on taking the Chair, thanked the Society for the unmerited complement, for, he said, to be even a member of a society of national reputation—yes, international reputation—for its character, intelligence and microscopical research, was of no ordinary significance. To be an *active* member was far more honor than to be a passive officer. The success of all organizations depended upon the active co-operation of the officers and the individual members, and this he hoped to secure the coming year. For his part he would say that if the Society did not have its full complement or number of meetings this year, it would not be his fault.

The business of the evening to this point had prolonged the meeting beyond the ordinary hour of adjournment, and as there was not time to consider the subject of Graphiology, a special meeting was appointed for Monday evening, March 21st, at which time the subject of individual muscular tremor would be considered. Adjourned.

A special meeting of the San Francisco Microscopical Society, at the society-rooms, 120 Sutter street, convened March 17th, 1881, to hear Dr. J. H. Wythe and others upon the subject of Graphiology. An unusual number of visitors were present by invitation, it being understood that the Doctor would prove his theory of individual muscular tremor, which he had advanced, or endorsed in his previous papers.

Upon calling the meeting to order, the President, S. W. Dennis, said: This special meeting has been called to consider, or, perhaps, I may better say, to more fully consider the subject of Graphiology, or the detection of forgery by the aid of the compound microscope. I believe you are all aware that it is a very important, as well as a very dangerous, subject, financially, commercially and legally. There seems to be no question that the microscope is an auxiliary to unaided vision, but there is some difference of opinion as to degree. As powerful as the instrument is, allow me to state that it cannot overcome human prejudices, mental delusions, or optical illusions. With your permission, Professor Wythe will open the discussion with a paper on the subject:

GRAPHIOLOGY.

Exposition and Ocular Demonstration of Microscopic Rhythms in Handwriting, by Professor J. H. Wythe, M.D.

At a former meeting of the Microscopical Society a request was made that I should give ocular demonstration of the rhythmical character of handwriting. As the object of all associated effort in scientific work is to help each other in the discovery and propogation of truth, I accede cheerfully to the request, and shall aim to exhibit clearly the methods of investigation for the promotion of the ends of justice to which reference was made in previous papers. Acting on a hint given by the retiring President, Col. Kinne, I have preferred to do this in the form of a written communication.

The application of the microscope to the detection of forgeries and disguises in handwriting, is a subject which has been growing in interest for several years. It has proved of great importance in comparing the texture of paper and the relative age of ink marks, as well as showing the presence of erasures or additions to written documents. It is now proposed to extend the methods of general experts in handwriting by a microscopic examination of forms and rhythms. In former papers I endeavored to analyze and classify these rhythms so as to place this method of investigation upon a scientific basis. It was claimed that in addition to the ordinary methods of examination resorted to by professional experts a comparison of the rhythms of handwriting under the microscope is a valuable means of research, amounting often to a positive demonstration of the authorship of a disputed signature or document. This I shall now further explain and demonstrate. Before doing so, however, I desire to refer to the general methods of comparing handwriting, and to the necessity of special illumination of the character under the microscope, since these subjects have an important practical connection with my theme.

Through the kindness of Mr. Norris, the Vice-President of the society, I have had the opportunity of examining and making extracts from a scarce and valuable work published in London, in 1871, containing photo-lithograph copies of letters of Junius, Sir Philip Francis, Lady Temple, Lord George Sackville, and others, with a professional investigation and comparison by Mr. Charles Chabot. This work contains a complete exhibition of the principles of comparison of handwritings, and concludes by expressing the conviction that "the Junian MSS. and the forty-four letters of Francis have all been written by one and the same hand."

The Hon. Edward Thistleton, in the introduction of the work, declares that "the principles which underlie all proof by comparison of handwritings, are very simple, and, when distinctly enunciated, appear to be self-evident. To prove that two documents were written by the same hand, coincidences must be shown to exist in them, which cannot be accidental. To prove that two documents were written by different hands, discrepancies must be pointed out in them which cannot be accounted for by accident or by disguise." In accordance with these principles, Mr. Chabot undertakes to prove the identity of Junius and Sir Phillip Francis, by seventy or eighty points of agreement, in the forms of the letters in their handwritting, or in habits common to both. Some of these coincidences are so peculiar and distinctive, that it is difficult to believe them to be accidental. Others, of less significance individually, become of importance from their cumulative power. Many are the result of rooted unconscious habit in Francis and others inadvertencies artificially acquired.

The comparisons of experts, as shown by numerous passagees in the work of Mr. Chabot, relate to the peculiar formation of letters and words and characteristic habits of the writers respecting dates, paragraphs, initials, punctuation, omissions, abbreviations and spelling. I am not aware of any special attention having been directed to rhythm, except a reference in the same work to the general method of disguise by altering the accustomed slope.

In examining the rhythm of handwriting under the microscope, I have already stated that careful illumination by means of a bulls-eye condensing lens is almost essential. An interesting case illustrating this was related by Professor R. H. Ward in his inaugural address, as President of the American Society of Microscopists. One party sued another to recover the value of a note. The defendant did not deny that the note was genuine, but claimed that it had been paid, and that the date was originally earlier than the date of the receipt and had been changed to its present date for purposes of fraud. Two figures of the date of the note were written in a handwriting which differed from the body of the note. The prosecution claimed, however, that there had been no change but that the note had been filled out several days before it was signed, and the places of these figures had been left blank until the time of the signature. The note was put into Professor Ward's hands for examination. The body of the note was written in a small hand with pale ink; the figures in question were written in a bold hand, with black ink. There was no evidence of erasure, nor any change in the surface of the paper indicating that it had been tampered with. On examining the figures with the microscope, he could find no evidence to prove that any other figure had been written in the location of the present figures, but by changing the illumination and resorting to a number of expedients, he at last discovered the faint outlines of a figure corresponding in size and shape with those of the other figures in the body of the note. This figure indicated a date earlier than the date of the receipt and corresponded with the statement of the defendant, thus proving that the bolder figures were forgeries."

The rhythms to which the attention of the Society has been asked, have been named respectively the rhythm of form, of progress and of pressure. As some criticisms have been made on certain points connected with these rhythms, I venture, even at the risk of some prolixity and repetitions, to enlarge upon them.

I—THE RHYTHM OF FORM.

As the general slope of the letters is the principal element in this rhythm, a microscopic examination is not essential, although often very useful in forming a judgment, especially if a moderate magnifying power is used. In some handwriting, the letters slope uniformly at one angle; in other specimens, at another angle; in some there will be habitual and rhythmic interruptions of the slope; and others will be habitually quite irregular. In disguised hands this rhythm will be the most changed, yet in writing of some considerable length, it will be strange if the writer does not, in some places, fall into his natural or accustomed rhythm. Of course, in comparing this or any other rhythm, the examiner is supposed to have before him enough of handwriting which is undoubtedly genuine, to enable him to judge of the normal rhythm.

II—THE RHYTHM OF PROGRESS.

By this is meant the tremulousness, or irregularity of the lines in the progress of the writing. It is seen either as a wavy line or irregular margin of the letters when illuminated well under the compound microscrope and magnified about ten or fiteen diameters. It is best seen in the binocular microscope. An article in the *Banker's Magazine* referring to this rhythm, and ascribing 200 to 300 variations in the inch, has been much criticised. The number of the vibrations, however, is quite unimportant, and will differ much with the circumstances of the writer as to health, emotion, or haste. Sometimes this rhythm will be seen only on one edge of a line, owing to the peculiarity of the pressure by the side of the pen on the paper. This one-sidedness, which is quite frequent, is a sufficient reply to the suggestion that the absorption of the paper is the cause of the rhythm. Bibulous paper will absorb ink, and cause irregular edges of pen marks, but it will not make tremulous or wavy lines. The tremulousness, also, is so differerent in the handwriting of different persons, that only personal characteristics can account for it. This rhythm is sometimes chiefly in the up strokes, and sometimes in the down strokes. In age, debility, or excitement, the tremor in the handwriting is visible without a microscope, although better seen with it, but in point of fact, as the microscope shows ever one's hand vibrates, more or less, it may not always be easy to trace the rhythmic character of this vibration, yet calm and patient study will generally determine it, after the microscopic examination of a few lines of writing.

To illustrate this rhythm, I quote from an article by Professor Curtis, of Chicago, in reference to a case related to him by Prof. Babcock: "A note was put into his hand for examination, with an endorsement upon it, which professed to have been written by one William Lill, who was dead. The note was not paid by the party making it, and the owner applied to the estate of Mr. Lill for payment. A large number of the signatures of Mr. Lill were given to Prof. Babcock for comparison. He noticed an unsteadiness in the lines of these signatures. In the earlier ones, this tremor was slight, hardly perceptible to the naked eye, and confined to the upward strokes, while the down strokes were firm and steady. This tremor increased somewhat in the later signatures. From this appearance, he concluded that Mr. Lill was an old man, who had been growing feeble for a number of years. The endorsement upon the note resembled, to the naked eye, the undoubted signatures very closely; but, on examining it with the microscope it presented some striking points of difference. The up strokes were even and smooth, indicating that the one who wrote it had a steady hand, quite different from the hand of the trembling old man who was supposed to have signed it. This case, however, is a somewhat exceptional one. The forger was an unusually bold man. As a rule, a young and healthy person writes his own name rapidly, and the lines, whatever may be said as to their beauty, are usually firm, while the forger, who writes slowly and anxiously, strives to imitate his copy, introduces as a consequence a certain tremor into the lines, which, on careful comparison with the genuine signature, at once betray the fraud." This case Professor Curtis related to show that however close an imitation may be, it is never so close as to avoid some imperfection which may be detected by careful microscopic examination. It illustrates, also, the rhythm which I have called the rhythm of progress. The rhythmic tremor of the writer, with the vibrations greater in the up strokes, was wholly different from the bold strokes of the forger, of the endorsement. One less bold would have exaggerated the rhythm.

III.—THE RHYTHM OF PRESSURE.

This rhythm is an alternation of dark and light lines, or parts of lines, from the more continuous pressure of the pen upon the paper. This also may often be seen by the naked eye, but sometimes requires and is generally observed better with the microscope. The rhythm is often very characteristic. Sometimes the pressure will be heaviest on every down stroke, or on certain parts of each down stroke. At others it will be noticeable only at initials, or curves, or at certain intervals. If I were disposed to claim originality in the investigation of rhythms in handwriting, it would be respecting this rhythm of pressure rather than that of progress, which has been far more criticised. I shall be content, however, if in classifying these rhythms I shall promote a scientific method of research by means of the microscope which shall be of practical value in business affairs. In order to fully illustrate, and I may say demonstrate, my theme, I have taken from my drawer five envelopes, numbered respectively 1, 2, 3, 4 and 5. They have been taken hap-hazard, and contain the same address, written by different persons. The following memoranda show the differences in their rhythms:

NUMBER 1.

First Rhythm—Regular slope from right to left of perpendicular, a light, free hand.

Second Rhythm—Generally regular, but the lower edge of horizontal lines are the roughest, (seen especially in the S. and Fr. of "San Francisco.")

Third Rhythm—Pressure uniform; heaviest on down strokes, with peaceful transitions.

NUMBER 2.

First Rhythm—Dropping toward perpendicular about every third letter.

Second rhythm—Tolerably regular, but the left side of stroke clear and right side quite rough.

Third Rhythm—Generally heavy, but irregular.

NUMBER 3.

First Rhythm—Regular. A backhanded writing with interruption of pen.

Second Rhythm—Very regular.

Third Rhythm—Down strokes, often exaggerated (rhythmetically) so as to split the point of the pen.

NUMBER 4.

First and Third Rhythms—Irregular.

Second Rhythm—Regular.

NUMBER 5.

First Rhythm—Tolerably regular.

Second Rhythm—Fine in the down strokes, pronounced in the up strokes; inclined to be roughest on right side of the down strokes.

Third Rhythm—Tolerably regular. Splits pen.

A comparison of these handwritings, by means of the binocular microscope, with an objective of four inches equivalent focus, and well-illuminated with the condenser, will convince any one of the truth of my position—that the microscopic rhythms of questionable handwriting should be compared with the genuine, as well as the forms of letters and habits of the writers, before a judgment respecting its genuineness is pronounced, and that such comparisons will greatly further the ends of public justice by enabling an expert to give satisfactory reasons for his opinion.

At the close of Dr. Wythe's paper, the President called upon Mr. Geo. C. Hickox, a well-known expert in the examination of handwriting. Mr. Hickox said he had but recently commenced to use the microscope in the examination of handwriting, but without its use he had many years ago discovered and noticed the peculiar style, or form of the writing of different individuals. He had termed it the idiosyncracies of a man's handwriting, but perhaps the word rhythm might be a better term to distinguish it. He said that he had also known, and seen, by his unaided vision, the peculiarities which Dr. Wythe termed the "rhythm of pressure;" yet, like the peculiarities of style and form, he had not thought to term it a rhythm. The other rhythm which had been mentioned, of "Progress," he had not examined sufficiently to give a positive opinion upon. He then proceeded to illustrate upon the blackboard his experience in several cases of forgery in which he had been called as an expert, and kept the audience for half an hour listening to his very interesting and instructive remarks.

The President then called upon Mr. C. H. Denison, who said that he supposed the evening would be devoted in listening to Dr. Wythe, therefore he had not expected to say anything, yet he was always ready, at a proper time, to give his views upon any subject to which he had given thought. It was well known to members of the Society, if not to others, that he had differed from Dr. Wythe upon the theory that a person could, by the microscope, distinguish an individual muscular tremor, which was peculiar to each writer, and could be seen by and be practically demonstrated to others. He differed, also, as to the discovery or claim of Dr. Wythe regarding the classification of handwriting. In his papers before the Society, Dr. Wythe had stated his discoveries and claims as follows:

First—The rhythm of Form.

Second—The rhythm of Progress.

Third—The rhythm of Pressure.

"The first I call the rhythm of Form," said Dr. Wythe, "because of its easy, flowing, graceful form;" whereupon, he made upon the blackboard a series of graceful curves and scrolls. Now I ask, in all sincerity, is there anything new in this so-called "rhythm of Form?" Has it not been known and distinguished as long as the art of handwriting has been practiced? Upon the pages of the old, illuminated missals in the early ages of the art, on the old parchments used by our ancestors, in the records of every old New England town, can be seen the same easy, graceful, flowing, rhythmical style, and it was distinguished, discovered, and admired two hundred years ago. Are we, then, to be gravely told that such a classification of easy, flowing, graceful handwriting is a discovery? Beside, I call your attention to the fact that Mr. Hickox says he saw it many years ago, but gave it another name.

I call your attention in the same connection to the third claim of classification, termed "Rhythm of Pressure;" but, as Mr. Hickox said likewise he had observed it many years ago, it really seems unnecessary for me to dwell upon it. It is old; has been previously known; therefore is not new. Leaving, therefore, these claims of originality where they are now placed by this testimony, we find the subject brought down to its true point, which is quoted by Dr. Wythe and myself in former papers, viz.:

Is there a muscular tremor amounting to a rhythm in the handwriting of every man, caused by nerve pressure upon the pen, seen only by the aid of the microscope, comparable by individuality with another, showing 200 or 300 variations to the inch, and which difference can be demonstrated to a Court and jury?

I say not, and I propose a test to Dr. Wythe like this: Ten persons shall write on any subject, upon as many separate sheets of paper, a dozen lines each, without signature; then write their names on other separate pieces of paper, a key of which shall be placed in the hands of the President, these to be examined by Dr. Wythe for a week, at the end of which time he shall tell us, if he can, which signature belongs to each sheet by the similarity of its rhythm, and then show the society where and how they are alike and where they differ. He has shown five envelopes here to-night to illustrate his classification, but nothing to prove the theory of muscular tremor.

And now, lest my position be misunderstood, allow me to say that I believe and know the microscope to be of the greatest assistance to the examiner of handwriting, and hope that it will soon be an acknowledged power in the practice of law, as it already is in the practice of medicine, but it must be used cautiously, and merit must not be claimed for it to which it is not entitled.

Dr. Wythe, in answer, said that his ideas upon the subject had been embodied and set forth in three papers before the Society, and he had nothing more to add but to reiterate what he had said in them.

The President invited several visiting gentlemen to express their views. One of the visitors "thought a classification of handwriting would be a step forward, and would enable examiners to proceed effectively in their search." Another gentleman said he "was glad Dr. Wythe was able to give a reason for the hope that was within him."

Mr. Denison said "if Scripture was to be brought into the discussion, *he* had a text which had occurred to him, and which was an apothegm as correctly applied to science, as religion: *Prove all things*, and hold fast to that which is good.

After a desultory talk of a few moments, the President dismissed the unusually interesting meeting.

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EXCHANGES.

Good uncleaned diatomaceous material, containing Arachnoidiscus, Heliopelta, Triceratium, Isthmia, Pleurosigma, Surirella Gemma, and Terpsinoe Musica, wanted in exchange for well-mounted slides of arranged diatoms, etc., or offers. Danl. G. Fort, Oswego, N. Y.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, England.

A Baker stand, also a new imported $12 Zither, to exchange for first-class objectives. Box 107, Astoria, L. I.

The Lathe and Its Uses, etc., for a Nobert plate or a Micrographic Dictionary. E. Pinckney, Dixon, Ill.

Wanted, a foreign microtome in exchange for a C clarionet, in good order and worth $35. T. S. C., Asylum, Toronto, Canada.

Wanted, diatomaceous deposits (about a bushel of each kind, by express), for good slides, material, or cash. Geo. B. Scott, Box 4,195, New York.

Wanted, a second-hand microscope with powers of 50 to 350 diameters, price $10 to $35; will give books and chemicals; for list address A. Meyer, Cogan House P. O., Penn., describing microscope and accessories.

First-class slides, palates of marine mollusca, and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens; lists exchanged. Rev. J. D. King, Edgarton, Mass.

Will exchange mineral specimens of Idaho for such books, minerals, curiosities, etc., etc., as I desire; Household Microscope wanted; state what you have to exchange, giving particulars. J. P. Clough, Junction, Lemhi Co., Idaho.

Selected and well-mounted diatoms, in exchange for other goods, slides, or material, etc. W. H. Tivy, 6th and Olive Sts., St. Louis Mo.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., care Editor this journal.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

A good microscope, costing $136 in Paris, in exchange for a good working spectroscope. Address "Spectroscope," care American Journal Microscopy, 14 Dey Street, N. Y.

THE AMERICAN
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AND
POPULAR SCIENCE.

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Trichinæ, Disease Germs, Etc.

IN the Philadelphia *Ledger*, of April 9th, appeared the following interesting letter from Prof. Leidy, which, like everything else from the pen of that able microscopist, deserves a careful perusal:

Frequent notices in the daily papers regarding pork infested with trichina, and its danger when used as food, leads the writer to make a few remarks on this and kindred subjects, in the view that they may serve to caution some persons and give relief to the fears of others. Abundant proof goes to show that the minute thread-worm, trichina, is ordinarily introduced into the human body by eating raw pork infested with the parasite. The trichina cannot be considered as common in the hog, occurring perhaps not oftener than once in ten thousand, and, as pork is usually not eaten raw, the chances of infection are few, though sufficiently frequent to be worthy of the greatest care. The parasite is not dangerous from any inherent quality, nor does it "eat up" the individual infested, as was intimated in the report of a recent case published in the newspapers. Its effects are proportioned to its numbers, each being a centre of irritation, and when they number millions, distributed throughout the muscles, they become so many "thorns in the flesh."

The temperature of boiling water will not only kill trichina but all other parasitic worms, so that by cooking meats all danger of becoming infested by them is removed, nor can any bad effects result, as no known parasitic worm is poisonous. All our food animals are liable to parasites, so that there is no use to think of discarding any one, especially as all are innocuous when cooked. The lovers of very rare beef occasionally receive the tapeworm as a guest, but the occurrence is rarer than the parasite, for the moderate heat to which the meat containing the latter has been subjected in most cases is sufficient to kill it.

The discovery of trichina in man was made by the English surgeon, Hilton, in 1833, and the worm was subsequently named by Owen. The parasite was first discovered in the hog, by the present writer, 35 years ago (see Proceedings of the Academy of Natural Sciences, Philadelphia, 1846, p. 108), in the meat from which he had dined. Luckily for him the meat was cooked and while he escaped trichinosis the trichina did not escape him. Observing minute spots in the slice of meat on his plate, he reserved the piece and examined it with the microscope, which revealed a multitude of diminutive worms coiled up and enclosed in cysts. Little then did he or others suspect the relationship of trichina in the hog and man, or that it was of any significance as an agent of disease and death; nor was it then suspected that the parasite was probably the cause which led the great lawgiver of the Jews to declare the hog to be an unclean beast, unfit for food. It is probable from the scarcity of good fuel in Palestine and other countries of the Orient, that, when pork was used as food, it was often eaten raw, and thus may have frequently given rise to disease and death, resulting from trichinosis, the nature of which is a discovery of recent date. Perhaps millions have died from trichinosis, through successive centuries, without any suspicion as to the source of the affection. A soldier in the late civil war said to the writer, "I wish I had as many dollars as I have eaten pounds of raw pork." Does not this suggest the idea that many soldiers have died of trichinosis who were suspected to have been victims of typhoid, rheumatic and malarial fevers?

Let all meats be properly cooked and all danger of parasitic infection is removed. The writer long ago suggested that primitive man was perhaps led to cook his food from the impression that he would burn the ugly worms he observed in skinning and preparing animals, and thus prevent their introduction into his own body. It is not recommended that meats should be excessively cooked; and even when rare they may be safely eaten, but there is no certainly against infection if they are used in a half cooked or nearly raw condition.

The writer is uncertain how far salting and smoking meats will secure us complete exemption from parasites, though in all instances in which he has had the opportunity of examing meats prepared in this way, and containing parasites, they were always dead.

Appropriate to the subject, an anecdote may be here related. Some years ago, in Charleston, S. C., at an entertainment, among other dishes served was one of the tail of the drum fish in nicely browned slices. The writer was helped to a piece, said to be particularly gelatinous and delicate. These qualities seemed to depend on a jelly-like substance imbedded in the flesh. Curious to know its meaning, the next day a drum fish was procured in the market, and on dissection of the tail, it was found to be due to a huge parasitic worm (*Acanthorhynchus*) coiled into a mass nearly as large as a hen's egg.

In conclusion, the writer may refer to another probably serious source of disease, and this is the dust of our cities. When we reflect that this is the dried and pulverised dirt and filth of our streets, derived from all kinds of refuse matter, its dangerous qualities may be suspected if they are not clearly obvious. Conveyed by the winds, it is diffused everywhere, and settles upon or adheres to everything. We inhale it, drink it and eat it with our food. A speck of mud on our bread excites disgust; but who minds the same thing when it is nothing but a little dust? If our food just brought from the market or the provision store is examined with the microscope, it is found to teem with the particles of dust, consisting of fine sand, bits of hay and straw, filaments of cotton from old paper and rags, wood fibres, hairs and scurf scales of man and beast, starch grains, spores, etc. Recent investigations render it probable that dust contains the germs of decomposition, gangrene, and contagious diseases.

While our view of the dangerous qualities of dust may be exaggerated, there is certainly sufficient reason to regard it with apprehension, and make it desirable to avoid it. Its subtle and all-pervading character render this to a great extent impossible, but it may be much reduced by the removal of its sources of supply—the accumulation of dirt and filth. For this purpose the streets should be kept clean, by sweeping and washing, and, to facilitate this, they should be as smoothly paved as will be consistent with safe walking and driving. Especially is this desirable in the vicinity of the depots of our provisions, the market houses, where, unfortunately, we often observe the greatest accumulation of dirt. The streets around our markets should have an asphaltum or other smooth pavement, and should be swept and washed weekly or oftener.

How to Mount the Starches.

MANY of the starches are not only very characteristic, but they are also very beautiful when viewed by transmitted or polarized light.

We have experimented a great deal to determine, if possible, whether the individual grains could be well preserved, for a long time, for they form an interesting addition to our cabinet. Our method of preserving the starches is as follows:

It is necessary first to have some aniline blue staining fluid, which we make after the formula given by Beale:

Soluble aniline blue, ¼ grain.
Distilled water, 1 ounce.
Alcohol, 25 drops.

A mixture is made of equal parts of glycerine and water to which is added a very little acetic acid, only two or three drops to the ounce.

To this mixture of slightly acidulated dilute glycerine is added the aniline blue staining fluid until the whole mixture is of a decided blue color.

A drop of this mixture is placed on a glass slide and some of the starch to be mounted is dusted over the top. This dusting can be done to the very best of advantage by touching the starch with a camel's hair brush and then slightly shaking the brush over the drop of colored glycerine.

The starch soon sinks in the mixture and the cover is applied. This method of dusting the starch is much better than stirring it in the mixture with a fine needle which almost invariably results in an admixture of air.

After the cover is applied it is pressed down quite firmly against the slide and all excess of the glycerine carefully removed. The slide is then transferred to the turntable and a thin layer of dammar or balsam-in-benzole placed around the border of the cover. This soon hardens and in a day or two we can finish with the white zinc or Brunswick black or other cements.

The effect of thus mounting the grains of starch is this: the grains themselves have not taken the staining in the least, neither will they ever take it; they retain their natural appearance surrounded everywhere by the blue glycerine, and the effect is most beautiful.

Specimens are in our possession that were mounted over a year ago in this way, and they are as perfect as the day they were prepared.—*L. R. S. in The Microscope.*

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Dr. Richardson and the Diagnosis of Blood Stains.

DR. RICHARDSON, although not the first to point out the fact that micrometric measurements afford a means of discriminating between the blood of different animals, was the first to bring it forward with the present claims to certainty. So many erroneous statements have been made in regard to Dr. Richardson's views, that we are glad to be able to present to our readers a recent and authoritative statement from himself. It was first addressed to the editor of *Gaillard's Medical Journal*, from whose columns we reproduce it.

Prof. E. S. Gaillard, M.D.

DEAR SIR—In accordance with your invitation, I beg to lay before your readers an abstract of sundry papers which I have published, during the last ten years, upon the Measurement of Red Blood Corpuscles and the Diagnosis of Blood Stains by the Micrometric method. This compilation of my own work seems more justifiable than usual, because some of the articles appeared in journals not now readily procurable.

The detection and discrimination of blood stains is a subject, in which every human being has a small but appreciable interest, because whatever makes the discovery and punishment of the crime and murder *more certain*, renders the life of each of my readers, and that of every civilized man, a little *more safe*.

Solomon declares there is no new thing under the sun, and it is indeed surprising how few of the modern scientific discoveries have not been in some degree anticipated by ancient philosophers; nevertheless, it seems to me that I can claim for these results of my investigations upon blood stains, with high power of the microscope, an absolute novelty; because, had the facts been known in former ages, they would have changed the whole current of human events.

Had, for example, a microscopist, armed with a good immersion lens of high power, been present when Jacob's deceitful sons brought in his favorite child's coat of many colors, dipped in goat's blood, how quickly the fraud could have been revealed to the sorrowing father, and the journey down into Egypt, the captivity of the Jews, and their subsequent deliverance by the great lawgiver, Moses, with all its momentous consequences to our race, have been totally prevented.

My first investigations in regard to the microscopic examination of blood stains, were published in the *American Journal of the Medical Sciences* for July, 1869. In this article I advocated the employment of high power immersion lenses (1-25th) in such observations, and asserted that by their aid I had been able to demonstrate that the residuum of a dried blood clot, left after the action of pure water—and so long mistaken by Virchow, Robin, and their followers, for "pure fibrin"—was composed chiefly of the cell walls of the red blood corpuscles, and that by proper management these capsules of the red discs could be brought clearly enough into view, to enable me to measure them accurately, and so distinguish the dried blood of man from that of the ox, pig and sheep, with a certainty disputed by Caspar, Wyman, Fleming, and other previous observers.

In my Handbook of Medical Microscopy, (Philadelphia, 1871), I gave an original woodcut (p. 284), which, for the first time, as far as I am aware, depicts the true appearance of a dried human blood clot, when acted upon by water, as described in my paper of July, 1869.

The possibility of recognizing blood globules, when dried *en masse*, is, of course, closely associated with, if not actively dependent on, their possession of a cell wall, as maintained in my paper, "On the Cellular Structure of the Red Blood Corpuscles," in the Transactions of the American Medical Association for 1870; this theory being mainly supported by experiments upon the gigantic blood discs of the meno-branchus, in which crystals of hæmato-crystallin were seen to prop out a visible membranous capsule. See also my remarks in regard to the red blood corpuscles of Amphiuma, in the Transactions of the International Medical Congress, Philadelphia, 1876, p. 488.

Indeed, as I have elsewhere remarked, if the red blood globules are simply homogeneous lumps of jelly-like matter (Beale), the chance of discovering any individual corpuscles in a mass of dry blood clot, however moistened, seems almost as hopeless as the search after individual rain-drops in a cake of melting ice.

Notwithstanding the reprint of this essay in the British *Quarterly Journal of Microscopical Science*, in August, 1873, Prof. A. S. Taylor published the second edition of his great work on The Principles and Practice of Medical Jurisprudence, wherein he asserts (vol. I, p. 538): "there are no certain methods of distinguishing, microscopically or chemically, the blood of a human being from that of an animal, when it has once been dried upon an article of clothing." Since Dr. Taylor's work is justly considered the highest authority upon its subject in English-speaking countries, I was impelled by his statement to continue my investigations in order to arrive, if possible, at the facts of the case; and in July, 1874, I published in the *American Journal of Medical Sciences* a continuation of my previous researches. In this paper, after combating the arguments of Taylor, Caspar, Virchow, Brucke, and others, I reported an attempt to *work out* a practical solution of the problem from actual specimens of blood handed me, at my request, for the purpose, in two series, by Prof. J. J. Reese and Dr. S. Weir Mitchell. These series each comprised samples of human, ox, and sheep's blood (the animals being selected as those to which murderers are particularly likely to attribute suspicious blood stains upon their clothing) and were examined according to the following method, which I still use and recommend.

"Small particles were broken up into fine dust with a sharp knife, upon a slide, and covered with a film of thin glass. A few drops of ordinary three-quarters of one per cent. common salt solution were then successively introduced at one margin of the cover, and removed at the opposite edge, as they penetrated thither, by a little slip of blotting-paper, thus washing away the coloring matter from the tiny masses of dried clot. When these particles were nearly decolorized, a drop of strong aniline solution (fuchsine) was allowed to flow in beneath the cover, and, after remaining about half a minute, was in its turn washed away and its place supplied by a further portion of weak salt solution."

Accurate measurements of ten of the least distorted corpuscles thus brought into view (given in full in the paper,) enabled me to easily distinguish each of the animal bloods from that of man, as I think any microscopist among my readers, who possesses good 1-16, 1-20, or 1-25 immersion objectives, can do, if they will devote sufficient time and attention to the experiment. This communication, accompanied by an illustrative woodcut, may also be found in the London *Monthly Microscopical Journal* for September, 1874.

Apparently overlooking the fact that my paper was the avowed continuation of a previous essay, in which I had expressly stated: "Although it must be admitted that the blood corpuscles of a few mammals approach so nearly in size to those of man as to render their distinction doubtful, yet, for the practical testing of blood stains in criminal trials, we will rarely find that such a decision is necessary, since, as a rule, justice only requires that a positive diagnosis shall be made between human blood and that of animals which are commonly slaughtered for food, such as the ox, the sheep, the pig; or of birds, as for example chickens, ducks, etc. (p. 56.) Dr. J. J. Woodward, Surgeon U. S. A., published a sharp criticism upon my remarks, in a learned and able article, entitled, "On the similarity between the red blood corpuscles of man and those of certain other mammals, especially the dog; considered in connection with the diagnosis of blood stains in criminal cases." (Vide *Am. Journal of the Med. Sciences*, January, 1875.)

To this I replied in the April number of the same journal, and more at length in the *Monthly Microscopical Journal* of London for June, 1875, that Dr. Woodward states he writes to point out that it is "never in the power of the microscopist to affirm truthfully, on the strength of microscopical investigation, that a given stain is positively composed of human blood, and could not have been derived from any animal but man." With this proposition I fully agree, contending, however, that whilst it is literally true, it is *not the whole truth*, because, as may often happen in medico-legal practice, *when evidence other than microscopical* narrows down the conditions of the case to the question, is this stain human blood or that of an ox, pig or sheep ? the microscopist can, from fair specimens of blood spots as ordinarily produced, affirm truthfully that the "given stain is positively composed of human blood," should it be really so. This second statement I believe Dr. W. will admit, as an additional part of the truth, and if not I undertake to convince him (as I have some other candid doubters among my friends) by incontestable evidence.

Our real difference, then, is not mainly upon matters of fact, but on a matter of opinion, respecting the *just prominence* which should be given to the circumstance that "the blood-corpuscles of a few mammals approach so nearly in size to those of man as to render their distinction doubtful."

Now, whilst I honor Dr. Woodward for the discharge of what he conscientiously believes to be his duty, it seems to me, with all due deference to his superior experience, that he has in the first place a little undervalued the caution and prudence of our numerous medical brethren, who possess microscopes without considering themselves experts, and second that he has overlooked a most important factor in the calculation which we both, perhaps equally, sought to make, of how to secure for humanity by our researches the maximum advantage with the minimum amount of injury. This factor I conceive to be the keen, sharp-witted lawyer, to be found not only in every city, but in every country town throughout English-speaking countries, who, whilst studying during a trial my essay, if it were brought forward to support the baseless pretensions of an unqualified microscopist, claiming to distinguish human from dog's or monkey's blood, would infallibly discover, that not one syllable of its carefully-worded statements could be constructed into warranting such a groundless assumption.

Hence, trusting to this powerful and omnipresent element, for the protection of two or three innocent persons, who might possibly be in danger through my agency of conviction for manslaughter, I felt whilst writing both my first paper and its continuation, that should I more than indicate the animals which render our conclusions doubtful, my work would be rendered really prejudicial to the interests of society. Indeed it was, I think, fairly to be anticipated, that if I should emphasize and reiterate the fact that science alone could not detect the falsehood of a criminal's story, if he cunningly asserted that suspicious stains were made by the blood of a dog, not only would I frequently obstruct the course of justice, but some jealous critics would utterly condemn my investigations, and compare me to a locksmith winning a wide reputation among the "dangerous classes," by an essay most minutely teaching thieves *the truth* in regard to the secrets of opening bank vaults and fireproof safes; or to a toxicologist publishing a treatise, setting forth *most faithfully* the method by which poisoners may best destroy their victims, with the least danger of detection in their crimes.*

It should be remembered, also, that in all cases a really innocent person, wrongly accused of murder on the ground of blood stains upon his clothing, etc., actually proceeding from that "constant" (yet rarely slaughtered) "companion of man," the dog; or from some of our unusual associates, such as seals, otters, guinea-pigs, etc., needs neither Dr. Woodward nor Dr. Richardson to prompt him to tell (and try to corroborate the assertion,) when first arrested, the *true* origin of the suspicious blood spots.

Such then were the arguments which influenced me to publish my researches in a guarded manner; but now, since Dr. Woodward has bravely taken all responsibility for harm that may ensue upon himself, I am glad, for the benefit of the *few* rash microscopists and dull-brained lawyers our countries produce, to state explicitly my full corroboration of the Doctor's assertions, and declare that as far as I am aware there is at present (1875) no method known to science for discriminating, microscopically or otherwise, the dried blood of a human being from that of a dog, monkey, rabbit, musk rat, elephant, lion, whale, seal, or in fact any animal whose corpuscles measure more than 1-4000 of an inch in diameter. Hence, therefore, until further discoveries are made, a microscopist's best efforts at revealing crime can only serve the cause of

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*The gendarmerie of Valenciennes have just arrested a Dutchman whose profession is, to say the least of it, extraordinary. He is a dealer in all sorts of instruments employed by burglars and thieves. When arrested he had in his possession a large stock of pamphlets giving the fullest directions as to the best plan for waylaying people on the high roads, and also how to kill them without any noise in case of resistance.—*Chicago Med. Jour.*, May, 1875.

right and justice in those cases where the criminal's attorneys, in spite of being *forewarned*, and consequently forearmed, are unable to prepare or suborn testimony to show that one of the creatures just enumerated has been killed in such a way as to produce blood-stains, which are likely to be confounded with those from the murdered victim. Of course, however, *a change in the prisoner's story*, so as to attribute the blood spots to a dog, monkey, etc.. *after* consultation with shrewd lawyers for the defence, or scientific friends, as in the case mentioned below, *must have great weight with the jury*, and go far to *put them on their guard against the crafty trick* attempted upon their intelligence.

That I was led to avoid reiterating and emphasizing this failure of our science by no unfounded apprehension of the evil likely to arise from dinning such knowledge into the ears of rogues, is proved by the fact that after my testimony was delivered in the Larribee trial at Franklin, Venango Co., Pa., the prisoner's "keen, sharp-witted lawyer" brought two female witnesses into court, who testified that on a certain occasion about the time of the murder, when the defendant's boots (on which were the suspected blood spots) were standing in the corner of a particular room, they were engaged in clipping the ears of a terrier dog, and just as they got one ear done the baby cried, and they were obliged to let go the dog, which ran round the apartment, shaking its head. and thus sprinkled the boots with its blood. Further to substantiate this tale, a dog with one ear clipped was exhibited to the jury, and sworn to as the very one from which the blood was shed. Fortunately, it so happened that I had examined one or two spots upon the prisoner's pantaloons, finding them to be human blood in contradistinction to pheasant's blood, *as he at first explained them to be;* and since the contrivers of this dog story apparently forgot that the pantaloons were not standing up in the boots, and consequently had no chance to become sprinkled along with them, their ingenious theory failed to gain credence with the jury, who brought in a verdict of guilty of murder in the first degree.

Looking back at this controversy after five year's interval, I am more than ever convinced that the impulses of a pure microscopist in this matter should be controlled by the dictates of the larger and grander science of sociology, which decrees that dangerous weapons, whether mental or physical, should not be placed in the hands of those enemies of society, the criminal classes. At any rate, I have the satisfaction of knowing that the course I followed was unreservedly approved by the *British and Foreign Medico-Chirurgical Review* for July, 1875, then probably the highest medical authority in England or America; and that Sir Robert Christison, in his classic work upon Poisons, took the same kind of care to avoid contributing to the success of murderers by any information he might give.

Probably few of the most enthusiastic—indeed, I might say, few of the most fanatical—devotees of pure science, would venture to approve the work of the natural philosopher, whose books were confiscated by "the gendarmerie of Valenciennes," although he proceeded upon the directly antagonistic principle to mine, of popularizing the truths of Nature among individuals who would be apt to use this knowledge to aid their violations of the law.

In February, 1875, I devised a simple method of demonstrating to a jury the obvious differences between the blood of man, and that of the various domestic animals slaughtered for his food. As perfected by subsequent experiment, this plan is as follows: Place near the upper right hand corner of a microscope slide, a small drop of fresh human blood, and then with a narrow strip of glass or metal, spread a thin streak of it diagonally across the glass, towards the lower left hand corner. Next let fall a drop of pig's blood, for example, upon the upper left hand corner of the glass, and spread a similar narrow stripe so as to cross the first one, at a very acute angle, forming a figure resembling an elongated capital X. On each side of the meeting point of the two lines, will be found (should the experiment succeed) areas, when the two kinds of blood corpuscles are in the same field of the microscope, and so placed as to afford excellent opportunities for direct comparison of their magnitudes. My lamented friend, Prof. Alfred S. Taylor, has introduced a wood cut taken from one of my "double slides," showing the marked contrast between human and pig's blood, into the last edition (Third) of his great work on Medical Jurisprudence; and Dr. B. W. Richardson, of London, told me a year or two since, that he had used the photograph of a similar "double slide" which I prepared for him, in the stereopticon, as a lecture room illustration, with gratifying success.

Being called upon in November, 1875, to examine a blood stain upon an axe-handle where the spot probably weighed less than 1-3000 of a grain, I was induced to contrive a mode of examining and corroboratively testing, very minute particles of blood, which I published in the Philadelphia *Medical Times* for November 13th, 1875, p. 78, as follows:

"Procure a glass slide, with a circular excavation in the middle, called by dealers a 'concave centre,' and moisten it around the edges of the cavity with a small drop of diluted glycerin. Thoroughly clean a thin glass cover about one-eighth of an inch larger than the excavation, lay it on white paper, and upon it place the tiniest visible fragment of a freshly-dried blood clot (this fragment will weigh from one twenty-five-thousandth to one fifty-thousandth of a grain). Then with a cataract-needle deposit on the centre of the cover, near your blood spot, a drop of glycerine about the size of this period (.), and with a dry needle gently push the blood to the brink of your microscopic pond, so that it may be just moistened by the fluid. Finally, invert your slide upon the thin glass cover in such a manner that the glycerined edges of the cavity in the former may adhere to the margins of the latter, and, turning the slide face upwards, transfer it to the stage of the microscope.

"By this method, it is obvious, we obtain an extremely minute quantity of strong solution of hæmoglobin, whose point of greatest density (generally in the centre of the clot) is readily discovered under a one-fourth-inch objective, and tested by the adjustment of the spectroscopic eye-piece. After a little practice it will be found quite possible to modify the bands by the addition of sulphuret of sodium solution, as advised by Preyer.

"In cases of this kind, where the greatest possible economy or even parsimony of material is needful, I would advise the following mode of procedure for proving and corroborating your proof of the existence of blood, so that its presence in a stain may be affirmed with *absolute certainty*.

"From a suspected blood spot upon metal, wood, leather, paper, muslin, or cloth, scrape with a fine sharp knife two or three or more minute particles of the reddish substance, causing them to fall near the middle of a large thin glass cover. Apply in close proximity to them a very small drop of three-fourths per cent. salt solution, bring the particles of supposed blood-clot to its edge, and proceed as I have already directed.

"After thus examining the spectrum of the substance, you may generally, by rotating the stage, cause the colored fluid to partly drain away from the portion, wherein, under favorable circumstances, should the specimen be blood, the granular white blood-globules become plainly visible, as do also cell-walls of the red discs. Among the latter, if your mental and physical vision is keen enough, you can by the aid of a one-twenty-fifth immersion lens and an eye-piece micrometer measure a series of corpuscles accurately enough to discriminate human blood from that of an ox, pig, horse or sheep.

Lastly, to make assurance triply sure, lift up the thin glass cover, wipe off the tiny drop of blood-solution and clot you have been examining on the folded edge of a thin piece of moistened blotting-paper, let fall upon it a little fresh tincture of guaiacum, and then a drop of ozonized ether, which will at once strike the dark-blue color of the guaiacum-test for blood.

"In this way I have actually obtained these three kinds of evidence, to wit, that of spectrum analysis, that of the microscope, and that of chemical reaction, from one single particle of blood, which, judged by a definite standard (see 'Handbook of Medical Microscopy,' Phila., 1871, p. 283), certainly weighed less than one fifteen-thousandth, and probably less than one twenty-five-thousandth, of a grain."

In 1877 I had an occasion to examine an axe spotted with blood when a murder had been committed with it twenty years previously; and in a fragment of the stain was able to discover and measure red corpuscles too large to be those of ox or pig.

In order to set at rest the objection that different races of mankind might possess red blood corpuscles of varying average diameter, I endeavored to utilize medically the opportunity afforded by our Centennial Exposition in 1876, which, by attracting visitors from every quarter of the globe, made it possible for me to obtain well authenticated specimens of blood, from many different nations. The samples were each procured by myself from the individuals mentioned, (sometimes only through much persuasion), by puncturing a finger with the quick stab of a cataract needle, pressing out a small amount of blood, applying a clean slide to the apex of the drop, and then spreading out the portion of fluid which adhered to the glass with the end of another slide. Instead of measuring all corpuscles, deformed or otherwise, in two directions, as proposed by Dr. Woodward, I preferred to determine the size of unaltered—*i.e.*, circular corpuscles only. One hundred corpuscles in each specimen were measured, and the dimensions, as I read them off in millionths of an inch, noted down generally by an assistant. The corpuscles of a Japanese averaged 1-3212; those of a Spaniard 1-3226; those of a Turk 1-3187; those of a Russian 1-3190; those of an Italian 1-3272; those of a Cherokee Indian 1-3215; etc., etc. Combining these results I found that of the 1,400 corpuscles each separately measured, the average was 1-3224 (·007878 mm.) the maximum 1-2777 and the minimum 1-4000 of an inch; 1158 or 83 per cent. measured between 1-3448 and 1-3030 of an inch in diameter, and consequently under a power of two hundred would appear about the same magnitude; 118, or about 8 per cent. were less than 1-3448, and 124, or nearly 9 per cent. were more than 1-3030 of an inch in diameter. The total number of corpuscles 1-4000 of an inch across was 6, or less than one half of one per cent. The total number 1-2777 of an inch in diameter was 10, or less than one per cent. *Vide American Journal of the Medical Sciences*, January, 1877.

Since these researches were published, I have received from my valued correspondent, Dr. John Day, of Geelong, Australia, a specimen of blood from "King Billy," the last of the Aborgines of that country. His corpuscles show no perceptible variation from the above standard, and we may, I believe, therefore, assert that more than four-fifths of all the corpuscles in human blood are nearly identical in magnitude, and that excessive variations from the average size in either direction, are so rare, as to be practically unimportant.

To sum up the final results of these observations I conclude:

1st. That in unaltered blood stains as ordinarily produced by the sprinkling of drops of blood upon clothing, leather, wood, metal, etc., we can by tinting with aniline or iodine as I recommend, distinguish human blood corpuscles from those of the ox, pig, horse, sheep and goat, wherever the question is narrowed down by the circumstances of the case to these limits.

2d. By the method I have devised we can measure the size of the corpuscles and apply the two corroborative tests of Tincture of Guaiacum with ozonized ether and of spectrum analysis to a single particle of blood-clot weighing less than one fifteen-thousandth part of a grain, a quantity barely visible to the naked eye.

3d. Hence, when an ignorant criminal attempts to explain suspicious blood spots upon his clothing, weapons, etc., by attributing them to the ox, pig, sheep or goat, or to any of the birds used for food, we can, under favorable circumstances, *absolutely disprove* his false statement, and materially aid the cause of justice by breaking down his lying defence even if twenty years have elapsed.

4th. But if the accused person is well enough informed to ascribe the tell-tale blood to a dog, an elephant, a capybara, or any other animal in the long list, my friend, Dr. Woodward, has benevolently taught him, it is utterly useless for us to attempt to dispute his story, on microscopical evidence as to the size of the blood corpuscles.

5th. In cases of innocent persons wrongly accused of murder, and really stained with the blood of an ox, pig, or sheep, testimony of experts founded upon measurement of the corpuscles would be valuable, but less conclusive, because under certain circumstances human blood corpuscles may *shrink* to the size of those of the ox, whilst under no known conditions do ox or pig corpuscles *expand* to the magnitude of those in human blood.

6th. In order to do away with ingenious objections of lawyers that the murdered persons may have been affected with some disease which altered the size of his blood discs, or that the articles of clothing, etc., upon which the stains were deposited had produced chemically or otherwise some similar change in their magnitudes, it is very important to obtain promptly, stains from the fresh blood of the victim made in the presence of witnesses upon portions of the prisoner's clothing or weapons analogous to those upon which suspicious red spots are found when he is arrested. When this cannot be done, spots of the murdered person's blood sprinkled on white paper, and fragments of his lungs and kidneys should be carefully preserved, the former by rapid drying, and the latter by preservation in diluted alcohol. These little precautions which may in any instance prove to be of infinite importance, should be earnestly impressed upon coroners, district attorneys, and policemen throughout the civilized world.

There are many minor points in connection with this interesting subject to which I should like to direct attention, but fearing I have already trespassed too far upon your courtesy, Mr. Editor, I will simply refer any curious reader to the various papers quoted above, and remain,

Very respectfully yours,
Jos. G. Richardson.

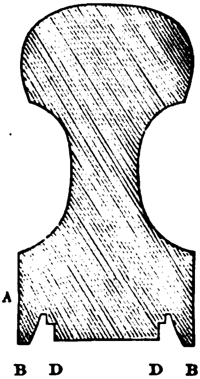
1835 Chestnut St., Philadelphia, Dec. 6, 1880.

A New Cell.

BY ROBERT DAYTON, M.D.

THE accompanying engraving represents a perpendicular sectional view through the centre of a metallic die or punch. The sides, A A, in the engraving, however, should be beveled to form a cutting edge at B B. By prolonging the sides and forming another cutting edge at D D, rings for transparent cells may be made, the raised edge forming an efficient protection to the cover glass.

Those wishing to manufacture their own dies, will finds the small brass drawer screw knobs very desirable, as they approximate the punch in form, and a number of sizes can be made to be attached or removed from a single wooden handle, as occasion may require.



CELL-MOULDING TOOL.

The process of making the cell or ring may be briefly described as follows:

Drop melted sealing wax or shellac upon a slightly warmed and oiled surface of plate glass, until material has accumulated sufficient to a little more than fill the die, press the die quickly and forcibly upon the melted material, and as the surplus resin exudes, revolve the die so as to cut through to the glass.

The cell produced by this process will be polished more or less in proportion to the finish the die has received in its manufacture. The advantages of this cell are, that it is easily and quickly made, and can be modified as to form, at slight expense. It can be attached to the slide and the covers to the cell, by means of heat alone, or by varnish. A thin or thick object can be mounted in the same cell by placing the cover, either upon the shoulder or upon the rim of the cell, and last, and not least, to those who have large exchange lists, their inexpensiveness, as they can be made for less than two cents per dozen.

Cleveland, Ohio.

Chloralania.

BY W. W. MUNSON, M.D.

BROTHER KING'S kind reference to my use of solution of chloral hyrate as a medium for mounting fresh algæ and other delicate objects, in the March number of this journal, reminds me of another use to which I have put this substance for some time.

Being often obliged to postpone the dissection, or other preparation, of such specimens as insects, I have got in the way of putting a little chloral hydrate into the water to preserve them. I find that this will preserve all animal tissues perfectly, without hardening or otherwise changing them, for any length of time. It is not necessary to observe any nicety as to the strength of the solution—five grains to the ounce of water, however, is strong enough for all small objects.

To be sure, the use of carbolic acid, which has worked such a revolution in the preparation and mounting of insects, does away, to a great extent, with the need of such a preservative—but sometimes we want to keep our objects in water till they are ready to mount. It is much more agreeable to dissect in water, anyhow, than in carbolic acid.

By adding chloral to the water, we may be as long about our work as we please, then pass the objects right along in carbolic acid, and from the acid into balsam at once.

Vegetable specimens may be kept fresh in the same way—it only being necessary to be careful to not get the solution too strong, or it will destroy the color. This may usually be avoided by using only a grain, or two, to the ounce. I say "usually," because the color of some plants, particularly green, is more easily bleached out than that of others.

Nothing, as it seems to me, is so elegant and generally agreeable, for the preservation of anatomical and pathological specimens, as this chloral solution. I exhibited a cancer of uterus at a meeting of our County Medical Society, that I kept for thirteen months, in a five-grain solution of chloral, in a jar on the top shelf of my office—quite a warm place, It was perfectly preserved, clean, without smell. soft, and to all appearance, in the same condition as when removed from the body. A human arm or leg, an entire cat or other small animal undergoing dissection, may be kept in this way, during the intervals of work, perfectly clean and without change, for any length of time. For such a purpose, a stronger solution will be required—from 10 to 20 grains to the ounce—according to the size of the "subject."

For some soft specimens it is better to renew the fluid occasionally, as small particles of the softer parts get washed off, making a deposit. This is never foul, nor in any way nasty, but it is more tidy to keep the solution clear.

Several other solutions do as well, no doubt, but I believe none of them are so cheap, so easily prepared and so inoffensive as solution of chloral.

II.

Those who have much to do with drugs and chemicals, know that when chloral hydrate and gum camphor are rubbed together thoroughly in a mortar, a peculiar fluid is the result—each apparently dissolving the other.

During the past year I have experimented some with this stuff, which I call "Dolly Varden," it being a sort of fancy affair—and find it to be a perfect preservative, and to increase the transparence of many dense objects to a remarkable degree.

I don't propose to say much about it now; but predict that *it has a future.* I will simply note that it dissolves readily in alcohol, carbolic acid and balsam; so it will be seen at once that it is not a very easy thing to hold in a cell if one wants to mount an object in it. But I think I shall master it. As it is not soluble in water, fresh tissues cannot be transferred directly to it. But, even if they are in water, by putting them into carbolic acid for a few minutes, they may be carried on to "Dolly Varden" in the same manner as into balsam. By "tissues," I have reference to animal tissues—particularly insects and their larvæ—at present.

Otisco, N. Y.

Living Trichinæ Wanted.

ONE of our subscribers writes to us for some flesh containing living Trichinæ. Any one who will send us a package of such material will confer a favor, and it will be duly forwarded.

An Omitted Credit.

WE regret that in our April number, we accidentally omitted to credit the note on "Vaccine Virus," page 83, to the *Medical Herald.*

Proceedings of the Detroit Meeting of the American Society of Microscopists.

WE have just received this volume, which is deeply interesting to all microscopists, and especially to the members of the society. It contains the President's Address in full. This is chiefly devoted to "deep sea soundings, and the relation of microscopic algæ to deep sea animal life, with a few remarks upon evolution."

The next meeting is to be held at Columbus, on Tuesday, August 9, 1881.

Asthmatos Ciliaris.

WE are in receipt of a note from Dr. Joseph Leidy, the well-known authority on Rhizopods, in which he says: "I still hold the opinion that it is nothing else than the ciliated epithelial cells of the air passages." Dr. Leidy's reasons for this opinion are to be found at length in an article published in the *American Journal of Medical Sciences*, 1879, page 85.

◆

Notes on Aperture, Microscopical Vision, and the Value of Wide-Angled Immersion Objectives.

WE have received advance sheets of the April number of the *Journal of the Royal Microscopical Society*, in which, under a caption the same as that of this note, the editor, Mr. Frank Crisp, gives an article of nearly 60 pages, illustrated with about 60 cuts. The article is ably written, though it seems to us that Mr. Crisp's imaginary opponents might not always accept the positions in which he endeavors to place them, and hence we anticipate a rather warm discussion as one result of its publication.

It is to be regretted that this article and the discussions which will undoubtedly follow, are not more accessible to American readers, and it seems, perhaps, a huge undertaking for our little journal, published at $1.00 per year, to give it to them. Nevertheless we have resolved to undertake it, and we presume that Mr. Crisp and the Royal Microscopical Society will not object. We do it wholly in the interest of science, and not in the expectation of any financial return, as it will very materially increase our expenses, and we shall make no extra charge to our subscribers.

◆

Correspondence.

Answers to Questions in Optics.

Ed. Am. Jour. Microscopy—Having seen in your columns a few questions concerning the refraction of light, I beg leave to answer them.

1st. Having given a plate of crown glass, refractive index, 1·525, with parallel surfaces, a ray of light, incident on the under surface at 45° from the normal, what will be the direction of the ray in glass?

From the conditions of the problem, we have:—

$$\frac{\sin 45^\circ}{\sin x} = 1{\cdot}525 \text{ or } \sin x = \frac{\sin 45^\circ}{1{\cdot}525}$$

whence $\sin x = 0{\cdot}46367$, whence $x = 27^\circ\ 37'$, or the angle which the ray in the glass makes with the normal is 27° 37′.

2nd. What will be the direction of its emergence in the air?

This problem is the reverse of the preceding.

$$\frac{\sin x}{\sin 27^\circ\ 37'} = 1{\cdot}525 \text{ or } \sin x = 1{\cdot}525 \times \sin 27^\circ\ 37'.$$

whence $\sin x = 0{\cdot}70711$ whence $x = 45^\circ$; or the angle which the ray makes with the normal on emerging into the air is 45°.

3rd. What will be the direction of its emergence in water?

Since the ray of light, while it is within the glass, makes an angle of 27° 37′ with the normal, we have:—

$$\frac{\sin 27^\circ\ 37'}{\sin x} = 0{\cdot}8743 \text{ or } \sin x = \frac{\sin 27^\circ\ 37'}{0{\cdot}8743}$$

whence $\sin x = 0{\cdot}53033$, whence $x = 32^\circ\ 2'$; or the angle which the ray makes with the normal on entering into the water is 32° 2′.

When the ray is incident on the plate of glass at an angle of 38°, the problems are analogous to the preceding cases, and therefore, the answers only are given.

1st. The angle made with the normal is 23° 48′.

2nd. The angle made with the normal is 38°.

3rd. The angle made with the normal is 27° 30′.

With regard to the reflection from the upper and lower surfaces of the glass, I may say that it is very trifling in comparison with the intensity of the incident ray, and the smaller the angle made by the incident ray with the normal the less the intensity of the reflected ray.

CLARENCE L. SPEYERS.

◆

"How to Use" and "How to See."

Ed. Am. Jour. Microscopy—"Don't I write too much for my health, doctor?" "No, but, perhaps, you do for your reputation."

Well, since I am not writing for reputation, and as the doctor strongly intimates that there is no danger of my expending sufficient brain force to impair my health, I venture an opinion about two recent books on the microscope, taking them in the order they come from the press, hoping to point out to some one a smoother and less expensive path to the instrument than the ones I have traveled.

"How to See with the Microscope," by Prof. J. Edwards Smith, of Cleveland, Ohio,, commences with a good foundation, in practical information about stands. The author, assuming the reader to be acquainted with the A B C of work, attacks his subject in a clear, bold and original manner—no conglomeration of other people's brains here—leading the student to the highest results in Microscopy. It is the first and only book, up to date, teaching how to use modern objectives of wide angled aperture. No one who knows enough of the microscope to place an object on the stage, and focus, should be without it. What you learn from it, you will not have to *unlearn*. Much that the writer learned from some of our standard authors, *practical experience* has *forced* him to *unlearn*. *This unlearning is a terrible task.*

Among the many able lessons in the work, the attention of the more advanced is especially called to "tone of objective" and "tone of field;" they, alone, being worth the price of the book. Some, even advanced, students and quasi-experts, may be disposed to pass over "tone" lightly; but, don't you do so, for there is significance in it which *you must learn to appreciate*, or ever be in the background. Grey Beard admits that he entertains views which, if given to the public, would make him the target of more than one *so-called* scientist—of *many* "so-called," it cannot be said that, *sciunt*—yet, on this point, "tone," the old man claims to know whereof he speaks.

Get the book; the truly expert need it now, and the novice soon will.

"How to Use the Microscope," by John Phin, editor of AMERICAN JOURNAL OF MICROSCOPY, takes the novice at the very first steps of the instrument, and carries him successfully through all elementary stages and beyond; a work which is needed by every one, even if he never expects to do more than to look through another's tube.

With this book and a *plantation* microscope, which I grade the same as a phyician's stand and outfit, costing from $35 to $50, there is not a mechanic, planter, or professional man in the country, who cannot become sufficiently expert as a microscopist to increase, by information gained, the profits of his trade or profession. To attempt to speak of its many good points would simply be to copy the book from beginning to end.

The author *does not claim* that the work is *perfect* or *exhaustive*, but Grey Beard *does claim most unhesitatingly*, that the beginner, or novice, in microscopy, can gain more real practical information from this little book, than most of the expensive standard works combined. Although not *especially* intended for the more advanced, it is worthy a place on the expert's table.

The time must and will come, when among well informed people, the microscope will be considered as essential about the house as a sewing machine, and in "How to Use the Microscope" we have the right book to prove the way to its intelligent and successful use.

GREY BEARD.

In the Swamps of Louisiana.

Blood Corpuscles.

Ed. Am. Jour. Microscopy—Every one who speaks for science, should speak for truth, and not only avoid direct falsehood, but also avoid conveying a false impression.

The heading of an article in the March number of your journal, conveys the impression, that there is a controversy between Dr. J. G. Richardson, and Dr. J. J. Woodward, and it appears from the article, that Prof. Smith endeavors to settle it, in favor of Dr. Richardson.

Dr. Richardson, in a paper "On the Value of High Powers in the Diagnosis of Blood Stains." published in the *American Journal of Medical Science*, July, 1874, gave certain measurements, made by himself, of blood corpuscles of man, and those of the ox and the sheep, showing conclusively, that, *under favorable circumstances*, human blood might be distinguished from that of those animals. At the same time giving measurements (certainly not his own), of the corpuscles of the pig, ox, red deer, cat, horse, sheep, and goat, all much smaller than those of man, showing that human blood might be distinguished from any, or all, of those animals named, and conveying the impression, that he could, with certainty, distinguish the blood of man, from that of any other animal.

Dr. Woodward, as well as others, received this impression, and, in a paper published in the same journal, January, 1875, criticises Dr. Richardson's statements, to which Dr. Richardson, in "An Explanatory Note in Regard to the Diagnosis of Blood Stains," published in the above named Journal, April, 1875, replies, quoting Dr. Woodward, that we can never "Affirm truthfully, on the strength of microscopical investigation, that a given stain is positively composed of human blood," and says "with this statement I *fully* agree." Thus the supposed controversy between Dr. Richardson and Dr. Woodward ended, as may be seen by reference to the above named papers.

There is nothing like controversy in the ultimate development of truth, and Prof. Smith revives the controversy, and attempts to show that he can, with certainty, distinguish human blood from that of several other animals, but he omits to name the animals, whose blood he examined in contrast with that of man, and, by dissenting from Dr. Woodward's views in regard to that of the dog, conveys the impression that he can with certainty, *under favorable* *circumstances*, distinguish human blood from that of any other animal which an expert would be likely to be called upon to examine.

Now I will have prepared, and furnish Prof. Smith, with half a dozen slides, some of which shall be of human blood, and some from other animals, to be found in this town, so that they may not improbably become the subjects of investigation by *experts*.

The fresh blood shall be spread thin and dried upon the cover, or in any other manner that Prof. Smith may designate, and marked from 1 to 6.

Corresponding numbers, together with the names of the animals from which the blood was taken, shall be sent to the editor of this journal. If Prof. Smith will examine and designate, to the editor, which are human blood and which are not, the results to be published in the JOURNAL. A. WATERHOUSE, M.D.

Jamestown, N. Y.

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The Model Stand.

Ed. Am. Jour. Microscopy—Under the title "The Model Stand," appears a very practical article in the May number of your valuable journal, by the Hon. J. D. Cox.

I have not the pleasure of the gentleman's acquaintance, and shall not attempt to intrude upon his patience or your space to criticize such points in his article as do not conform to my own views, which, by the way, are few. But I would like to add, in a spirit of criticism, a few words regarding one point he takes up and recommends, and then, in continuation, suggest a way to avoid—and that is his endorsement of the reversible stage. It seems to me that the stage is a part of the "Model Stand" that should remain fixed as it is now placed by most makers; for no one can but admit that simplicity and stability in an "instrument of precision" are attributes of perfection, and should be our aim in modeling a "Model Stand."

The more complexity, the more movements, the more joints contained in it, the greater the liability of its becoming, by years of *constant* use, an instrument of *torture* rather than "precision."

Every ingenious microscopist will invent abundant methods of obtaining by devices of his own all the advantages afforded by the "tilting" or "reversible" stage. The manner suggested by Mr. Cox to obtain by another way one of the most important advantages offered by the reversible stage is by use of the immersion illuminator. And his own experience I would fully endorse, after more than a year's immersion illuminator, by means of that valuable accessory known as Tolles' "Traverse Lens."

In order to avoid the loss consequent upon selling or throwing away my old Zentmayer Intermediate Stand, to obtain one of the modern ones with "swinging sub-stage," I conceived the idea of having the traverse lens fitted to my old stand, thinking I might thereby gain some of the advantages of the modern stands. And constant use and experiment have proven that in my first hopes "the half had not been told."

I know *now* of but one or two minor advantages obtained by means of the latest improved swinging sub-stage stands not possible with my present arrangement. In fact, I use it constantly wherever *directly* transmitted light is needed. The simplicity of same, and ease with which the light can be directed upon the object *from the mirror or lamp alone*, whether strictly central or oblique, from 1° to the limit of the stage; whether using it in immersion contact with slide for the highest angle homogeneous immersion objectives, or those of low angle or dry lenses; over balsam, fluid or *dry* mounted objects, *or using it in a manner never, I believe, before suggested, not even by its maker*, namely, as a dry illuminator for any use to which an achromatic condenser would be put, it commends itself at once as a universal illuminator for transmitted light, and seems to me to entirely obviate the necessity for the reversible stage motion in the "Model Stand" of Mr. Cox. I would heartily recommend and extend his views of using instead the immersion illuminator, which, in the form I use, I know to be simple and effective, furnishing also a valuable method for economy to the working microscopist who has an old-style stand with rack and pinion sub-stage, and whose longing for a modern one exceeds the limit of his purse. I would also, at this time, like to impress upon those not familiar with this piece of apparatus, that it is capable of other uses than resolving lined tests and diatoms, or *proving* as it was the humble instrument of doing, some years ago, in the hands of its renowned maker, that objectives could be made having greater interior angle, and transmitting light from the object to the eye at an angle greater than the "critical" angle in crown glass.

Those familiar with histological objects can very soon convince themselves that the traverse lens is of practical use in such studies, and can be constantly kept upon the stand, ready at all times for obtaining views which I have not been able to get as promptly in any other manner.

A. A. BRAGDON.

519 Columbus Avenue, Boston, Mass.

Encouraging the Use of the Microscope.

The following letter explains itself. We hope that Mr. Bulloch's liberality will bring forth rich results in more than one direction.—[Ed. Am. Jour. Microscopy.

Ed. Am. Jour. Microscopy—In order to stimulate more interest in the study, and greater efficiency in the practical working of microscopy, Mr. W. H. Bulloch, of 126 South Clark street, Chicago, offers an annual prize of $50, for five years, in the form of a microscope stand, to the student, from any chartered college in Chicago, passing the best examination in the theory and practice of Microscopy at the time of his graduation. Said prize to be awarded on competitive examination conducted by a committee of competent microscopists. The following gentlemen have consented to act as examining committee: Prof. I. N. Danforth, M.D., Rush Medical College; Prof. Charles Adams, M.D., Chicago Homœopathic College; Prof. Lester Curtiss, M.D., Chicago Medical College; Prof. E. S. Bastin, Chicago University; Mr. E. B. Stuart, Cor. Sec. Illinois State Microscopical Society.

It is to be hoped that the enterprising classes of each institution will furnish good candidates to contest for this prize.

E. P. Murdock, M.D.,
Curator, Rush Medical College.

Chicago, April 27, 1881.

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A Scientific Exposition.

The American Association for the Advancement of Science, will meet in Cincinnati, on August 17th.

During its meeting, there is to be a special exhibit of scientific apparatus and collections, which will be in charge of the Department of Science and Arts, of the Ohio Mechanics' Institute. Immediately following the Association opening, Sept. 8th, will be held in the same building, the annual Cincinnati Exposition, through which the exhibit will remain in order to compete for a special premium list.

The dealers and manufacturers of microscopes will be especially interested, as a gold medal is offered for the best display of microscopes and accessories, and a silver medal for the best set of slides not less than fifty in number.

Certificates of superior merit will also be awarded for the best microscope stand, the best object-glass, and the best polarizing apparatus.

Quite a number of makers have already signified their intention to exhibit; and as the Exposition Commissioners offer medals and awards for chemicals, chemical and physical apparatus, engineering instruments, and various objects in natural history, the collection will doubtless prove not only interesting to the general public, but of profit to the exhibitors.

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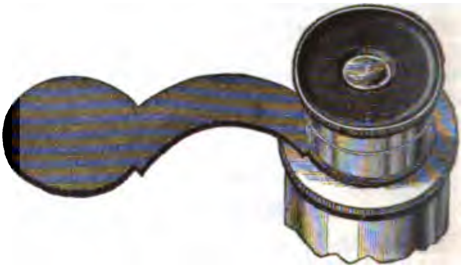
Eye Shade.

In using the monocular microscope with both eyes open, many persons find a difficulty in withdrawing their attention from objects seen by the eye which does not look through the tube. To obviate this, Mr. E. Pennock has devised a shade which slips on to the eye-piece, as shown in the engraving. This cuts off the view of articles lying on the table, and enables those who are inexperienced to use the microscope for a long time without tiring the eyes.



PENNOCK'S EYE SHADE.

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Micro-Organisms in Surgical Diseases.

Dr. Alexander Ogston presents an elaborate report on this subject to the Scientific Grants Committee of the British Medical Association (*Brit. Med. Jour.*, vol. i., 1881, p. 369), in which he reaches the following conclusions. The organism most closely examined was the micrococcus, though others also are figured in the drawings accompanying the report. In inflammation the results are summed up as follows: Cold abscesses contain no micro-organisms, and their pus is harmless. Acute and pyæmic abscesses always contain micrococci. Pus whose micrococci are killed by carbolic acid or high temperatures is harmless. Pus containing micrococci is resisted by animals if the dose be minute or if it be injected into the peritoneal cavity. Doses of one or two minims injected into the subcutaneous tissue may cause death by blood-poisoning, or may cause sphacelus of the site of injection, or may be resisted by an unusually insusceptible animal. As a general rule, such doses produce acute inflammation, accompanied by blood-poisoning and ending in abscess.

The results of observations on wounds and suppurations other than abscess are thus summed up by Dr. Ogston. Suppurating wounds contain micrococci, whose numbers and activity are proportionate to the intensity of the suppuration. Listerian dressings prevent micro-organisms from gaining access to wounds. Micrococci in wounds withstand most antiseptic applications. Where no micrococci are present in wounds, no pus is produced; the discharge is serous. Micrococci exist wherever pus occurs, save in chronic suppurations, such as cold abscess, chronic acne vulgaris (?), etc. Micrococci in man produce the same varying effects as in animals: they may produce blood-poisoning without suppuration; they may cause suppuration; or they may be resisted by strong individuals under favoring circumstances. Lastly, there are, possibly, micrococci which do not produce suppuration.

Cultivation experiments showed that micrococci do not produce putrefaction. They develop best when removed from the atmosphere. The facts adduced by Dr. Ogston prove that micrococci are able under suitable conditions to give rise to blood-poisoning, to acute inflammation, and to suppuration. Dr. Ogston adds in conclusion, that it is not intended to be conveyed by anything which he has said that micrococcus is the only organism which produces inflammation and blood poisoning. The other organisms are to be investigated in their turn, and much yet remains to be done, for the subject is only in its infancy.—*Medical Times.*

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The Comfortable Turn-Table.

At the suggestion of Dr. E. D. King, of Jacksonville, Ill., Messrs Queen & Co., make a turn-table similar to that shown in the cut. It will be seen that the revolving plate is set under the flat table on which the hand usually rests. Thus a rest is formed for the hand immediately over the work, which is a convenience that we think will be appreciated by many.

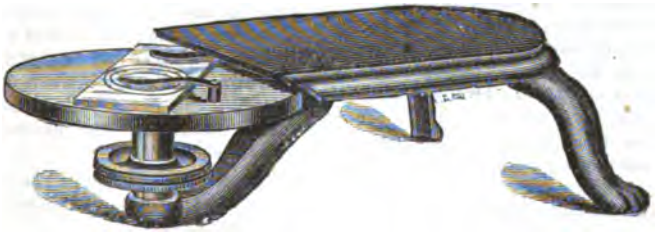
TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Elmira Microscopical Society.—The regular monthly meeting was held in the surgical institute, April —, 1881, with President Gleason in the chair. A large number of the members and many visitors were present. After reading and approval of the minutes, Messrs. F. M. Blossom, and J. C. Greeves, were elected members. The annual meeting which would fall upon the evening of May 7th, was postponed to the time of the next regular monthly meeting, and notice given of the intended presentation of a motion at the next meeting providing for a change in the constitution that shall bring the annual meeting upon the last Thursday in May of every year. The secretary was ordered, by resolution, unanimously carried, to prepare and have printed a neat pamphlet containing the constitution and by-laws of the society, and the names, addresses and occupation of its members, together with such other information as he may deem essential for the convenience and information of the society.

Considerable discussion was had upon the best course to pursue in making original investigations, and for the instruction of the younger members in the art of manipulating the microscope and preparing and mounting objects for examination.

The secretary thought one hour of practical demonstration by an expert manipulator and mounter was worth more than any number of papers that could be written upon the subject. He related his own experience in seeking information upon these points, in which he said that, after he had read everything published bearing upon the gathering and mounting of specimens, his real instruction—that from which he obtained the largest amount of information—was from personal interviews with those distinguished microscopists—Prof. H. L. Smith, Dr. J. J. Woodward and Dr. Black-



THE COMFORTABLE TURN-TABLE.

ham and witnessing their work. He therefore advocated short discourses, accompanied with practical illustrations, from those most skilled, in the society, in the two departments mentioned.

The president approved of these suggestions and complimented the club upon their fine equipments and facilities for doing work. Said he had visited many microscopic societies and had found none with better instruments with which to work than our own society. He advocated energetic work, now that the warm rays from the sun are developing and starting into life myriads of curious and interesting organisms.

Dr. Krackowizer suggested that several sections be organized, one on algæ, entomostracæ, diatomaceæ, physiology, etc., with a leader to each section who seems to have a liking for the department to which he is assigned. Such a division of labor seemed to be for the best interest of the society and met the approval of its members. The matter was postponed for further consideration at the next meeting.

Mr. A. Searles then continued his theme commenced at the last meeting, "What is a cell?" A synopsis of his elaborate and scientific paper might be given under a few heads, showing the scope and treatment of the subject. The cell, in its morphological conditions and relations presents to us all the phenomena of animal and vegetable life. He commenced with its invisible, unknown and unknowable origin; then, called attention to its visible and knowable parts, referring to the six differently constructed elements which, in all their combinations produce the statical part of animal and vegetable life. These combinations, as shown by chemistry and mathematics, are not accidental, but are under the controlling energy of a *law* older than the elements, and which operates with a precision that admits neither of mistake nor variation. The atom is the unit of the cell. The molecule, though the beginning of organized life, alone, cannot repeat itself, but, from an innate, inherited principle, can unite with a dissimilar unit, from which union the cell is formed. In the unity of homogeneity we have unmanifested existence! In the duality of heterogeneity, we have the beginning of life in its morphological and amorphological manifestation. Independent unity is a practical nonentity. Solitary duality [though organic in constitution] leadeth not to continuance, while unifric triunity may unlimitedly repeat itself. The first, (the atom), says, "I was." The second, (the molecule), says, "I have been and I am," while the cell triumphantly exclaims, "I was, I am, and I shall be!" The perfect human blood corpuscle in its atomic, molecular and cellular structure constitutes the highest type of physical cell known to us. They are heterogeneous and possess a two-fold nature, one of which is received from food, air, etc., the other from the nerve cell. Through its primitive and visible part (by the aid of the nerve cell) its function is to impart life to the different individualized organs and to control the automatic movements of the organism. They do not originate in some special organ, they are found in the ovum before any special organs exist. Although any adult blood cell (under the microscope, with the powers we now have) presents no material difference from any other cell of the same kind in the same organism, still, there may be more difference than there is between an Anglo-Saxon and an African; for, the perfect, highest type of a human blood cell must include the general lineage of the whole animal kingdom, from the first individualized animal up to man; and, as there are special organs with special functions, so there are differently constructed blood cells, having their origin and termination in the special organ to which they belong. The perfect blood cell, when it leaves the lungs, meets with no change until it reaches the capillaries; here it gives out something it had and receives something it had not, while in this act it changes from an arterial to a venous blood cell—being a change in constitution and polarity similar to the change of an alkali to an acid. The venous blood cell having an opposite polarity from the arterial one, must move in an opposite direction.

The paper then goes on to show the various kinds of cells, dwelling particularly upon the *leucocytæ*. It showed that if a hog or a monkey ever became a man, it must be through disintegregation and complete reconstruction of their cell-life, under the law of individuality, to the plan on which man is constructed. A blood cell cannot repeat itself, neither can a nerve cell produce an organism similar to the one to which it belongs and which it has vitalized; but there is a cell that differentiates from the two that can originate a similar organism with such variation as would arise through differentiation in the general line of evolution, and this cell is related to the other two as the radical of a chemical compound is to the other members of the group. The proliferating energy of the cell was next treated upon, to the end of the paper, constituting one of the most interesting that has ever been brought before the society.

The secretary was appointed essayist for the next meeting, and to give practical demonstrations in the mounting of objects.

The members remained until a late hour, viewing the varied forms of cell structure under the microscope. Five new stands, with accessories, have been purchased by the members since the last meeting. Adjourned to meet the last Thursday in May, at which time occurs also the annual election of officers.

THAD S. UP DE GRAFF, Secretary.

Buffalo Microscopical Club.—A spectial meeting of the Buffalo Microscopical Club was held at the Central School building, April 19th, for the purpose of allowing the members an opportunity to listen to Prof. Albert H. Chester, of Hamilton College, President of the Oneida County Microscopical Club, whose subject was: "The Mounting of Opaque Objects." We may remark that the preparation of the class of microscopic objects referred to has proven one of the most difficult that is met with by microscopists. Their great beauty and practical interest to all observers, and particularly the value of many of them to the mineralogist, makes a successful method of mounting a long-wished for-necessity.

Prof. Chester said in substance: In mounting opaque objects the chief difficulties to be overcome are in fixing the object to the slide, and in preventing the cement from running into the cell after mounting. After many trials I have adopted the following method: The objects, if light, are attached by means of a thin solution of gelatin. A little spot of the solution is dried on the slip, and the objects are then placed upon it and attached by breathing on the slide. This is then allowed to remain on the hot plate until all moisture has been driven out. If a heavier object is to be mounted, a circle of Brunswick black is turned on the centre of the slip, which is then placed on the hot plate until so hard that the object will not sink into it. It is allowed to cool, the object placed in position and fixed by heating for a moment over the lamp. If just the right amount of heat has been applied, the object will be firmly attached, but will not sink into the cement. The slide is then placed on the hot plate, where it remains until the japan is baked perfectly hard, so that no subsequent heating will soften it.

After the objects are fixed and sufficiently heated, they are allowed to cool, and the ring applied to make the cell. This ring is of tin foil, made as described in a recent number of the AMERICAN JOURNAL OF MICROSCOPY. A ring of black cement is carefully applied to the cooled slide, and the tin ring pressed into it. Care is taken that none of the cement comes into the cell. This cement is a quick-drying dead color, used by coach painters, and I think will soon be put on the market in tubes for use in mounting. It is thick, and sets in a few minutes. If necessary another tin ring is laid on top of the first, in the same cement, and the cell is in this way built up until the cover glass will be close to the object but not touching it. The cover is then put on with the black cement, clipped and set away. In an hour the clip can come off, and another coat of black may be applied. This must dry hard, which requires several hours, when another coat is put on and left to harden. The next day a coat of shellac cement is put on. This should not be too thick, and the mount should be examined carefully to see that no holes are left in the shellac. The next day the white zinc may go on to fill up the angles and make a smooth surface, and in two or three days the final finish may be applied. It will thus be seen that the slide is completely finished in four or five days from the time it is started; that there is no need of having a lot of cells made in advance, but that each one is made to suit the particular object it is to contain, and if proper care be taken the object will be firmly attached to the slide and there will be no running in. Of course some experience is required to know just when the conditions are fulfilled to insure complete success, but it may be attained in the use of the means I have just pointed out.

For fluid mounts in cells I use the tin rings, cementing them to the glass with shellac, which I generally thicken with Chinese vermillion. After the object and fluid are put in the cell, the cover is laid on, the excess of liquid pressed out carefully, and the whole dried with blotting paper. Some of the thickened shellac is then put around the edge of the cover, and left to harden. In an hour the slide can go on the turn-table, and a ring of shellac may be applied. No clip should be used. The next day the slide may be carefully washed and dried, when it is ready for another shellac ring. After this is set the white zinc may be put on as usual. Of course the fluids used must not be those that dissolve shellac, but camphor water or glycerine may be used without fear.

At the request of the President, Professor Chester gave his methods of procuring crystals of the various metals, as follows:

The beautiful and rare crystals of gold of hexagonal form were prepared by first dissolving the gold in ten or twelve parts of mercury and boiling for several hours. The mercury is then dissolved out by means of nitric acid, and the crystals of gold left of hexagonal shape, their beauty depending upon the perfection of the process. The silver, tin, copper and other metallic crystals were best obtained by precipitation of the metals by means of the battery. To obtain tin crystals the simplest method was to immerse the end of a bar of tin in a strong solution of the chloride. A thin layer of water is poured on top. In a few days the crystals of tin will be found attached to the bar in the layer of water, as a result of electric action.

San Francisco Microscopical Society.—The regular semi-monthly meeting of the San Francisco Microscopical Society was held Thursday evening, April 7th, 1881, at its room on Sutter Street, the members appearing promptly at 8 o'clock. President Dennis occupied the Chair. Another printed list, being the second one in a month, of California fungi, was received from Dr. H. W. Harkness, who is the most indefatigable fungologist upon the Coast. With Dr. Harkness searching for and studying fungi, and Denison after lichens, the Society should be well informed about these interesting flowerless plants. Two gentlemen, eminent in science, were proposed for honorary membership, the propositions being laid over until the next meeting under the rules. The principal discussion of the evening was upon the good and welfare of the Microscopical Society, and the fact was made known that many valuable papers and lectures were in process, and that the present year would be a notable one in the Society's history. The committee reported that the preparations for the annual reception, to be given in May, were in a forward state, the Secretary's list showing a sufficient number of exhibitors to promise an unusually successful meeting. Dr. Bleasdale, the visitor of the evening, read a paper concerning the proposal to establish or appoint an entomologist, to be connected with the State University, and who should act as a kind of health officer of plant life.

The members approved the suggestion of the Horticultural Society, and the officers of the Microscopical Society were instructed to use the influence of the Society whenever and wherever they thought it would assist in accomplishing the project.

No more efficient instrument than the microscope can be found to discover the presence and habits of the acari, injurious to vegetation, and thereby form plans to circumvent and destroy them. In the determined warfare now waging against insect pests for the safety of our vineyards and orchards, the microscope comes to the front and points out the positions of the enemy, making their destruction easier, quicker and permanent.

The meeting adjourned at a late hour.

The regular meeting of the San Francisco Microscopical Society was held at the Society's room, 120 Sutter Street, on Thursday evening, April 21st, 1881, President Dennis in the Chair, and an old-time quorum present.

President John Le Conte and Prof. Joseph Le Conte were elected honorary members of the Society. The library received a number of additions. Considerable business was transacted regarding the welfare of the Society. The annual reception was fixed for the evening of May 6th.

A paper was read on artificial ruling of lines, which will be printed at some future time. This led to an animated discussion on micro-engraving and the artificially-ruled lines on Nobert's test plate. To the reader it may be explained that what is known as "Nobert's test" is a plate of glass, on a small space of which, not exceeding one-fiftieth of an inch in breadth, are ruled from ten to nineteen series of lines, forming as many separate bands of equal breadth. In each of these bands the lines are ruled at a certain known distance, and the distances are so adjusted in the successive bands as to form a regularly-diminishing series, and thus to present a succession of tests of progressively increasing difficulty. The highest, or the band of lines most difficult to see, is the nineteenth. Not all the microscopists in the United States or Europe have been able to see that band.

The celebrated microscopist, Dr. Woodward, it is said has resolved the lines, and photographed them, and so have many gentlemen in the Eastern States and in California seen them, but it is a very delicate, difficult test. In the great International Exhibition, 1851, M. Foucault, of Paris, exhibited a specimen of micro-engraving, supposed to be unsurpassable for minuteness. Soon after this, Mr. Peters, a London banker, constructed a machine on the principle of a pentagraph or eidograph, by which was engraved the Lord's Prayer so small, that if all the words in the Bible and Testament were written the same size, the whole might be comprised 22 times over in one square inch.

Mr. Webb has gone far beyond this, having engraved a Lord's Prayer in which each letter does not occupy the 200 millionth part of a square inch, and in which latter space (on a scale of equal proporton) the whole Bible and Testament might be inscribed fifty-nine times.

This seems at first incredible. It is confessedly difficult, if not impossible, fully to realize and appreciate such a statement. But these are not mere ideas, they are substantial facts, and are as capable of demonstration as that 3 is the half of 6, or that 12 times 12 are neither more nor less than 144.

Let us see. I have before me two engravings of the Lord's Prayer. The micrometer assures me that the first, called A, forms a parallelogram, in which the longer side is the 1-120th, and the shorter the 1-132d part of an inch. The prayer is composed of 227 letters. Now if 120 × 132 = 15,840, then the writing occupies the 1-15,840th part of a square inch, and the number of letters must bear some proportionate relation to the number in the Bible, about three and one half millions. The other specimen called B, is smaller, but the same principle applies to both. The 227 letters here form a quadrangle, the 1-530th by the 1-600th of an inch; consequently this writing occupies (530 × 600 = 318,000) the 1-318,000th part of a square inch, while the 227 legible letters in this space will sustain the same relation above to the number in the Bible.

In the English Bible and Testament there are 3,566,480 letters, and it is easy to show that the scale of size in the specimen A is equal to the whole Bible being written once in the area of an inch, while the smaller specimen, B, would admit of the whole Bible and Testament being inscribed twenty times in the same space. This can be proved. Simple arithmetic and the sublime rule of three are equal to the task.

Example A.—If 227 letters occupy the 1-15,840th part of one inch, how many times could we write

3,566,480 letters of the same size in that space? 120 × 132 = 15,840 × 227 = 3,595,680 + 3,566,480 = One Bible.

Example B.—If 227 letters occupy the 1-318,000th part of an inch, how many times could we write 3,566,480 letters of the same size in that space? 530 × 600 = 318,000 × 227 = 72,186,000 ÷ 3,556,480 = Twenty Bibles.

The above would satisfy the most rigorous mathematician; he would say, admitted that the original measurements are correct, the results must be equally so. Grant the premises, and no sane person can deny the conclusions. It is true, but it does not satisfy an intelligent apprehension. We believe it, because we cannot deny or disprove it, just as the astronomer admits the existence of boundless space because he cannot conceive any limit to its extent, or believes time to be eternal, from his inability to conceive either beginning or end.

The Secretary read a list of exhibitors at the annual reception in May, and spoke of some of the objects to be exhibited. More living organisms are to be shown than heretofore, and the two geological ages of gold will be illustrated by ground transparent sections of rocks and cabinet specimens of associate rocks, with samples of gold to contrast the colors. The meeting of the evening had so deep an interest to some of the members, that when the Secretary left the Society room to take the 10.40 ferry-boat for Oakland, he left a number of interested observers looking through the microscopic tubes, and the time when they adjourned as yet he has no knowledge.

Microscopical Society of Central Illinois.—The regular meeting of this society was held April 21st, President F. L. Matthews, M.D., in the chair. Dr. J. H. Detmers, of Chicago, was elected an honorary member. Five person were elected to active membership, two of them being ladies.

The paper for the evening was read by T. B. Jennings of the U. S. Signal Corps. His subject was "Protophytes and Protozoa, or Simplest Forms of Vegetable and Animal Life Compared." He took the ground that animal and vegetable life represented the two arms of the letter V, and that the protophytes and protozoa formed the base or junction of the arms. Starting out with the vegetable life, he explained the composition of the cell, showing the difference between the cellulose cell wall, and the albuminous primordial utricle, and their separate functions—the cell-wall being merely protective, while the primordial utricle took an active part with the protoplasm in the work of the cell. Taking up some of the simplest plants, he explained in detail the method of growth, increase by binary sub-division, and process of generation of the unicellular plants.

He then explained the animal cell, showing that in its complete form it is comparable in most parts of its structure to that of the plant, but has no cellulose wall.

At the conclusion, he stated that the safest guide for distinguishing between the protophytes and protozoa, was that laid down by Dr. Carpenter, that is, "The *nature of the aliment* of the protophytes and protozoa respectively, and in the method of its introduction, the protophyte absorbs its nutriment from the air and moisture surrounding it, the same as the highest plants; while the protozoon in common with the highest animals, obtains its food from *organic* substances, which it takes into itself and there digests." Dr. Matthews had a live fish under his large Crouch's instrument, showing the circulation. Rev. Mr. Reed had piece of a leaf of the lichen on which were some beautiful minute shells. Other members had interesting objects.

The society instructed the Board of Directors to report at the next meeting—May 19th—the propriety of, and time for holding a microscopical soiree at an early day. This society is incorporated under the laws of the State of Illinois.

Illinois Microscopical Society.—The annual meeting of the Illinois State Microscopical Society, was held at the rooms of the Academy of Sciences, Chicago, April 22, 1881, B. W. Thomas, President, in the chair. The secretary not being present, C. S. Fellows, Esq., was appointed secretary *pro tem.* The minutes of the previous meeting having been read, the usual reports received and referred, the Society was then entertained by Dr. McIntosh, who exhibited a new and improved form of solar microscope, combining an oxy-hydrogen attachment. The histological slides shown by this apparatus were fine, and called forth very general admiration. The society being again called to order proceeded to the election of officers, resulting as follows: President—Dr. Lester Curtis. Vice-Presidents—Prof. E. S. Bastin, Dr. F. W. Mercer. Secretary—William Hoskins. Treasurer—W. H. Summers. Trustees—E. J. Hill, B. M. Thomas, W. H. Bulloch, Chas. E. Boring. Meeting then adjourned.

Central New York Microscopical Club.—A regular meeting of the above named society was held on the evening of Tuesday, April 26th, at the office of Dr. Aberdein, at Syracuse, President Collins in the chair.

A paper sent by S. A. Webb, Esq., of Oswego, was read by the secretary; being an account of some original observations on the method of reproduction of *Chilodon Cucullus.*

Dr. W. W. Munson, of Otisco, followed with some remarks on the minute anatomy of the flea of the wood-chuck (*Pulex arctomys*), illustrated by several balsam mounts of different organs of the insect beautifully dissected.

After the transaction of some miscellaneous business the meeting adjourned.

Oneida County Microscopical Society.—A regular meeting of the Oneida Co. Microscopical Society, was held in its rooms, 120 Genesee St., Utica, N. Y., Monday evening, April 25th. The reader who had been appointed for the evening, was excused on account of sickness. The president occupied an hour very acceptably in describing his method of mounting opaque objects, and in describing, and commenting upon the Gundlach stands, and objectives exhibited by Mr. Hodges, the Physician's Stand was fitted with Gundlach's new fine adjustment, which was greatly admired for its delicate, and sensitive motion. The objectives shown were like all the productions of this maker of exceptional excellence. Mr. H. C. Main, of Rochester, was invited to meet with us at our May meeting, and address us upon the subject to which he has given so much time, and study—Diatoms. GEORGE C. HODGES, Secretary.

Wellesley College Microscopical Club.—The regular meeting of the Wellesley College Microscopical Society was held Monday evening, April 25th, the Vice-President, Miss French, in the chair.

Professor Nunn gave a very interesting talk on Embryology, the material for which was derived from observations made by herself during the summer of '79, on the Mnemeopsis, an animal of the genus Ctenophare. Miss Nunn accompanied her remarks by drawings made on the spot as the subject required.

Professor Whiting gave a description of the larynx, illustrated by a model, and several experiments in sound. This was introductory to several slides for the microscope, illustrating sections of the larynx, showing especially the vocal cords.

The society had recently received a number of very choice botanical slides. Several of these were under the microscopes.

LUCIA F. CLARKE, Cor. Secretary.

New Microscopical Society in Oswego, N. Y.—Since our last issue a new society has been formed at Oswego, N. Y., as the "Oswego Microscopical Society." Its officers are: President, S. A. Webb; Vice-Presidents, E. D. Milliken and E. Burrows, M.D.; Treasurer, Rev. Father Meagher; Recording Secretary, Thomas McGinnis; Corresponding Secretary, Miss Julia B. Douglas. It starts out with about fifteen members, and fair prospects for doing some good work.

* * *

EXCHANGES.

Good uncleaned diatomaceous material, containing Arachnoidiscus, Heliopelta, Triceratium, Isthmia, Pleurosigma, Surirella Gemma, and Terpsinoe Musica, wanted in exchange for well-mounted slides of arranged diatoms, etc., or cash. Danl. G. Fort, Oswego, N. Y.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, England.

A Baker stand, also a new imported $12 Zither, to exchange for first-class objectives. Box 107, Astoria, L. I.

The Lathe and Its Uses, etc., for a Nobert plate or a Micrographic Dictionary. E. Pinckney, Dixon, Ill.

Wanted, a foreign microtome in exchange for a C clarionet, in good order and worth $35. T. S. C., Asylum, Toronto, Canada.

Wanted, diatomaceous deposits (about a bushel of each kind, by express), for good slides, material, or cash. Geo. B. Scott, Box 4,196, New York.

Wanted, a second-hand microscope with powers of 50 to 350 diameters, price $10 to $35; will give books and chemicals; for list address A. Meyer, Cogan House P. O., Penn., describing microscope and accessories.

First-class slides, palates of marine molusca, and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens; lists exchanged. Rev. J. D. King, Edgarton, Mass.

Will exchange mineral specimens of Idaho for such books, minerals, curiosities, etc., etc., as I desire; Household Microscope wanted; state what you have to exchange, giving particulars. J. P. Clough, Junction, Lemhi Co., Idaho.

Selected and well-mounted diatoms, in exchange for other goods, slides, or material, etc. W. H. Tivy, 6th and Olive Sts., St. Louis Mo.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., care Editor this journal.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving P. angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 W. 17th St., N.Y.

* * *

HORSFORD'S ACID PHOSPHATE.

FOREST, O., April 13, 1881.

I take pleasure in stating that I have used your Horsford's Acid Phosphate, in several cases of chronic gastritis, marked by peculiar red tongue, with gratifying results. I also find it an excellent menstruum for the administration of Comp. Tr. Cinchona, in recovery from malarial fevers where there is impaired digestion. By combining it with Scudder's Specific Tr. of Pulsatilla, I find it very satisfactory in controlling nervousness in females, and quite pleasant to take.

A. S. MAY, M.D.

THE AMERICAN
Journal of Microscopy,
AND
POPULAR SCIENCE.

VOL. VI. NEW YORK, JULY, 1881. No. 7.

The Distribution of Living Matter in the Dental Tissues.*

BY WM. C. BRITTAN, DENTIST.

IN the presentation of this subject, the object is mainly an inquiry as to the possible incorrectness of some present theories in regard to it as demonstrated by the microscope.

In a paper under the above title, read before the American Dental Association, at a meeting held at Niagara Falls, August, 1878, was given what is now, I believe, commonly known as the "protoplasmic theory" of the distribution of living matter in the teeth.

The author of the paper referred to, is a gentleman who has the reputation of being a careful histologist, and I have every reason to believe that he is such, but, from my own observations in regard to this subject, I am inclined to believe that he has made some errors, and has based his opinions more upon the supposed discoveries of Prof. Heitzman, than upon unbiased personal investigation.

The "paper" states that in 1873, Prof. Heitzman discovered the minute structure of protoplasm. And that of other tissues, mainly epithelium and connective tissue.

Prof. Heitzman, describes the net-like structure of protoplasm thus: "The nucleolus is connected with the wall of the nucleus, and this again with the granules of the protoplasm by very fine threads, which must be regarded as the living matter of the protoplasm, while the fluid contained within these meshes of living matter does not possess the property of life."

This structure being identical in all protoplasmic formations.

Prof. Heitzman, we are also told, discovered that there does not exist a tissue within the animal body built up of cells, as taught by Th. Schwan, what formerly was thought to be a cell, (a vesicle with a fluid and a nucleus suspended therein), has, since 1861, though the researches of the late Max Schultz, been recognised as a jelly-like mass, the so-called protoplasm.

He also attributes the movements of the cilia of ciliated epithelium to the constant action of this same living matter throughout the epithelial body. The cement substance of all epithelial and endothelial formations is pierced by fibres of living matter.

The above theory seems to have been the basis upon which the writer referred to space with the light showing distinctly through them. Associated with these are others filled with a ring of dark red color, this ring closely fitting the interior of the canaliculus, and showing sharp outlines, (*b*). This open space, or hole (*a*), is what I shall call the canaliculus, and the ring within it (*b*) the tubulus. In the centre of this ring is the small roundish dot (*c*) which corresponds identically with what is described as the fibre of living matter, but which is in reality the true opening through the tube. I judge this, because in very thin sections, I see the light shining distinctly through this "dot," and showing a plainly visible opening. In the first instance, the tubulus has been detached, and removed; in the latter it still remains intact. From such measurements as I have been able to make, I judge the average diameter of these tubuli to be about 1-1200 mm., the thickness of their walls about 2-5ths their diameter, and the opening through them about 1-5th. That these appearances are reasonably interpreted, I think any one would admit after an examination of these slides. In my experiments, I have been unable to observe that the walls of the tubuli are any more dense than the basis substance, but am inclined to the opposite opinion, owing to their facility of absorbing coloring matter. Again we are told, that in specimens that are stained, the fibres (Fig. 1, *b*), show a distinct violet color, characteristic of living matter within protoplasmic formations, while the *space* (*a*), between the fibre and the wall of the canaliculus remains unstained. In my own specimens this is just the reverse. In these, the walls of the tubules (the so-called space) (Fig. 2, *b*), is stained, while the supposed fibre, (the opening in the tubulus) (*c*), remains unstained, as also, the basis substance (*d*). We are also informed in the "paper" that in oblique sections, there can be seen both longitudinal and transverse projections of the fibres. This appearance I have sought for more than any of the others, but have been unable to observe it. In longitudinal sections, I have seen undoubted projections of the tubuli, but never of anything resembling the supposed fibre. In oblique sections are seen, what may have been supposed to be projections of the tubuli, but I am quite convinced that the appearance is owing to the transparency of the basis substance, for by changing the focus of the instrument, the tubuli may be clearly traced throughout the entire thickness of the section. In longitudinal sections of well injected specimens, this appearance of a fibre will be found entirely wanting, the whole interior of the canaliculus presenting a uniform appearance in regard to color, the porous walls of the tube with its central canal being equally filled with the injection. In structure, I judge these tube walls to be porous, or spongy in texture, from the prompt manner in which they absorb coloring matter, also, in what has been described as the denticulated or fringed appearance of the supposed fibre—an appearance that could possibly be produced by such a condition of structure. Acids decalcify them, but potash does not remove them, therefore, they may be supposed to be calcareous.

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* Paper read before the Griffith Club of Microscopy, March 2nd, 1881.

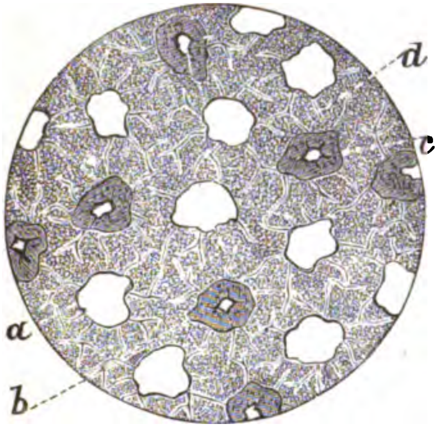


Fig. 2.—CROSS SECTION OF DENTINE INJECTED.

a—Dentinal canaliculus, the tubuli removed.
b—Dentinal tubule.
c—Central canal of tubuli.
d—Basis substance.
1,500 +

In regard to the methods given, as it would seem to me that decalcification should be regarded as valuable in what it may reveal, simply as *one* of the very many methods that should be employed in the investigation of these minute structures. When we consider that by the process of decalcification, we have only twenty per cent. of the original structure left, and that consisting of a collapsed gelatinous substance, the eighty per cent. removed being the frame work and support of the structure, how much of all that is comprehended in this subject could we reasonably expect to find in such a residuum ? These tubuli with their collapsed and wrinkled mouths, might be supposed to be almost anything except that which they really are. On the contrary, the more various the methods employed, the more reliable will be the knowledge gained.

In the investigation of this subject I have noticed two characteristics of structure which I do not remember to have seen before recorded, viz: the *parietal walls* of the canaliculi (Fig. 2, *b*), and the *lamelated structure* of the dentine.

Mr. Nasmyth, however, came very near the truth, when, in 1853, he pronounced the supposed tubuli of the dentine to be not tubes at all, but "solid fibres composed of a series of little masses succeeding each other in a lineal direction like so many beads upon a string." It will, therefore, seem that he had very good reasons for such a supposition, when we know that, owing to the lamelated structure of the dentine just referred to, the tubuli may be divided into just such "little masses" as he then described. No microscope is required to demonstrate that this lamelated characteristic is not a mere supposition, but a fact. By boiling a fresh specimen of a young tooth in caustic potash, the lamellæ may readily be detached from around the root in distinctly concentric layers. The cementum being first detached, which may often be removed from the apex of the root in the form of a cap.

In regard to the function of these tubuli, it has occurred to me that it would not be unreasonable to suppose a metamorphosic power to exist in them, or that they allow such elements from the plasma of the blood to pass through their walls as may be required for the nutrition of the structure, taking up one element and rejecting others, according to their condition of aggregation and the laws of their chemical composition and affinities.

This, of course, is only conjecture, yet, the laws that govern these infinitesimal realms are so little understood that we have to accept very much that is really only conjecture. An ordinary lifetime is insufficient to more than gather up a few facts and arrange them in proper relations, still the earnest pursuit of knowledge continually brings us nearer the foundation of absolute truth.

March 2nd, 1881.

A Handy Insect Cage.

BY F. N. TILLINGHAST.

WHILE out collecting insects for microscopic purposes, I have hitherto been under the necessity of filling my pockets with numerous small boxes for confining the insects caught.

It is generally troublesome, and sometimes almost impossible to introduce a third or even a second insect into a common box, without letting one or two of them escape. I have, therefore, been led to devise the little piece of apparatus described below. Fig. 1 is an exterior, and Fig 2 a sectional view of the box. G is a rectangular piece of glass which forms one end of the box, L, is a tin lid, which, when closed, forms the other end of the box. When opening and closing, it swings horizontally on a pivot, P, and when closed is held in place by the wire fastening F. S, is a tin slide, which, when pushed in, divides the box into two compartments, A and B, (as in Fig. 2). It passes through one of the narrower sides of the box, and slips through two grooves cut on the inside of the wider sides. It should be bent or rolled upon itself for a short distance at both ends at the inner end, to prevent its slipping out of the box entirely, and at the outer end to form a projection for the thumb-nail to press against when the slide is being opened. When an insect is to be placed in the box, the tin slide, s, should be closed (when there is another insect in compartment B), the lid opened, and the insect placed in compartment A. The lid, L, is then closed, and the slide, s, opened. The insect, observing the light through the glass, G, at the other end of the box, and intent on escape, passes from compartment A, to compartment B. The slide, s, is then pushed in, and compartment A is ready to receive another insect. The box may be constructed entirely of tin (except the glass end G, and wire fastening F), or it may be constructed at almost no cost, of a few pieces of old cigar box, a couple of pieces of tin, and a piece of glass held in place by a few narrow strips of heavy paper gummed on.

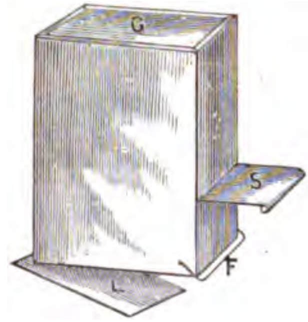


Fig. 1.

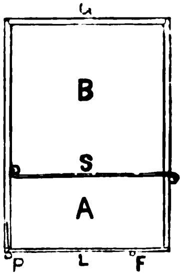


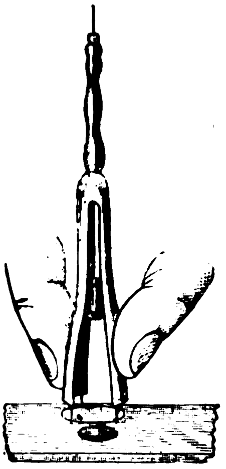
Fig. 2.

I have found this box to be a very handy little article when out on a collecting expedition, as it takes the place of quite a number of common boxes.

Greenport, N. Y., April 25, 1881.

A New Form of Mounting Forceps.

IN order that the readers of the JOURNAL may more clearly understand the construction of Mr. Mason's mounting forceps, exhibited at a recent meeting of the American Microscopical Society of New York, and described somewhat in detail in the April number of this journal, the accompanying engraving has been prepared, which so well illustrates this convenient device, that but little further description is needed. The engraving shows a cover glass as held in the forceps, and about to be placed over the object on the slide. The small cork or wedge between the sides, just above the thumb and finger, completely regulates the spread of the points to suit any size. The sides being thin, a slight pressure holds the cover firmly.



MASON'S MOUNTING FORCEPS.

The forceps used for the engraving were made from a piece of white wood, which was first turned into the general form, and then a small hole was bored lengthwise through the centre. After this, the lower end was split with a fine saw, and the ends of each side slightly hollowed out with a small knife.

The four pins—which form the clasping points—were pushed into place after cutting the heads off. The pin in the upper end makes the tool—when held in a reversed position—convenient for turning out tissues or arranging position of objects on the stand.

Every one who has had experience in mounting objects for the microscope, knows how difficult it is to lay the cover in the desired position with the ordinary form of forceps. The cover striking the balsam or other mounting material at a greater or less angle, is liable to slip from a central position, which detracts much from the beauty of the finished work, and if moved about to get it into position, the object is often injured or displaced. The principle can be carried out in a more simple form than that shown in the engraving, a turned piece of wood is not at all necessary. Two pieces—sufficiently large to hold the pins firmly—may be wound with thread about one-half their length, and will serve the worker's purpose quite as well.

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Some Expert Testimony.

"Science will not tolerate philosophical dogmas, nor accept the authority of any master, no matter how illustrious he may be."—*Motto of the London Royal Society.*

PHOTOGRAPHS of blood corpuscles used in the Hayden murder trial, made by Dr. J. J. Woodward.

On one of these I have based the measurements in this paper. This is dated 1876, and marked "Negative 821—New Series."

In the stenographic report of this trial (pp. 51, 52) lines running across the photograph are alluded to. Dr. Woodward, in reply to a question, said these lines were "those of the micrometer on which the blood is spread."

Question. "Isn't that line in your picture twice as thick at the end of the picture as it is in the centre?"

Answer. "Yes, sir."

Q. "Did the photograph make this?"

A. "No, sir; the microscope. The photograph showed what the microscope showed."

This appearance of thickness of line, as seen on the photograph, is due, of course, to the law of optics, as says Dr. Woodward in answer to the next question.

Q. "Will you tell me if anything produces the difference in the ends of these lines accidentally, or is it by this law of optics?"

A. "O yes, it was produced by the law of optics."

This being the fact it follows that objects —other than these ends of lines, such as blood corpuscles—situated at a greater or less distance from the centre of the field, must be subject to more or less enlargement in proportion to their distance from the centre, and it follows from this last that all measurements of blood-corpuscles made in this manner, either on the photographs or the negatives themselves, must be incorrect.

Q. 2nd, on page 48. "Is it a vulgar notion or a scientific fact, that 'from the centre of the picture,'....'or near the centre;'....'is it not a law of optics that the object will grow larger out toward the circumference?'"

A. "Certainly."

What, then, means the answer to question 2d on page 49, "whether it is not true that fifty corpuscles reproduced with perfect skill, etc., will change their size as they approach the edge of the field?"

A. "I don't know this to be true, and don't believe it."

Q. 6th, on page 47. "Isn't it true as a law of optics that from the centre of the field to the margin of the best photographs the difference of size goes out quite from the centre."

A. "No, sir. That arises from the vulgar error that the curvature of the field is a section of the circle, etc."

Upon measuring the photograph in question I find the two spaces between the micrometer lines near the centre of the picture to be about one and a half per cent. less than the next two spaces toward the outside. The spaces following, reaching to the outside of the picture, not occupying quite the distance between the micrometer lines, of course, could not be measured on this picture, but by actual measurement of a Rogers' micrometer, with a Hartnack about one-twelfth, magnifying 1128 diameters, I find the variation of the compared inner spaces to be the same as in the photograph, i.e., one and one-half per cent., while in the next space, which corresponds to the outer one in this picture, the difference is ten per cent. This, together with the fact that the curvature of the field prevents all parts from being in focus at the same time, sufficiently accounts for the thickening of the micrometer lines on the picture, as before noticed and admitted by Dr. Woodward.

The area of the whole circle of six inches is nine times as great as that of the inner circle of two inches, which last is very near the diameter of this circle formed between the two lines bounding the two inner spaces on the picture. Hence, this outer space should have an average of eight-ninths of the blood corpuscles in a given case.

Now, an increase of five per cent., only in the received average measurement of human blood-corpuscles (e.g., 1-3200 of an inch) would carry the average to the 1-3058 of an inch; and as Dr. Woodward claims (report, pp. 53-4) that he finds the average to be higher than the 1-3200 of an inch, here is sufficient reason for his conclusion.

If the report from which I have quoted be correct, and of this there seems no good reason to doubt, are there not some strange discrepancies in these answers which it would seem difficult to reconcile? For my own part, I don't believe that there is any accurate method of measuring the diameter of blood corpuscles outside of the centre of the field of the microscope.

R. U. Piper.

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American Society of Microscopists.

THE next meeting of the American Society of Microscopists will be held at Columbus, Ohio, on Tuesday, Aug. 9th, 1881. The President is Prof. J. D. Hyatt, New York; Secretary, Prof. Albert Tuttle, State University, Columbus, Ohio; Treasurer, Geo. E. Fell, Buffalo, N. Y.

The American Association for the Advancement of Science holds its annual meeting during the following week at Cincinnati.

Experiments in Regard to the Temperatures Attained by Cooked Meat, with Special Reference to the Distinction of Trichina Spiralis and other Parasites.

BY PROF. E. PERRONCITO, M.D., TURIN.

THE following interesting and highly instructive communication, which we reprint from the *Veterinarian*, contains the substance of researches recently published in the *Annali della R. Accad. d'Agricoltura di Torino*:—

With the view of resolving the question so important to public health, as to whether the usual method of cooking fresh and salted pork be sufficient to kill the animal parasites that might, in using the meat, enter into the human body, I undertook a series of experiments in my own laboratory, as well as in the shop of a sausage-maker, who allowed me to do so. Having already experimentally demonstrated that the greater number of helminths and the larval forms belonging to them die at a temperature of 48—50° C., if only kept up for five minutes, the question was reduced to seeing what time was necessary for a temperature of 50° C. to penetrate to the middle of the largest pieces of meat, fresh or salted, and if, with the usual boiling, this condition was effected in different kinds of sausage and salted meats. Here are the experiments made and their results:

1. A piece of veal from a calf one year old, about 7 centimeters thick (or 2¾ inches), and 9½ decimeters broad (or 4 inches), after ten minutes' boiling was at 53° C. in the centre. After twenty minutes' boiling, in different parts it was 63°, 65°, and 66° C.

2. A square-shaped piece of rump of beef, 8 centimeters thick (or 3 inches), and 4 inches broad, put into boiling water; after twenty minutes the centre was half raw, though it showed a temperature of 47° C., and after thirty-five minutes parts of it were found at 68° and 70° C. It is well known that pieces of meat of this size are cooked at least for an hour, so that the temperature would rise many more degrees.

3. A ham, weighing over 12 lbs., put into cold water, was found to have 25° C. of central temperature when boiling point was reached. After thirty minutes the thermometer indicated at different parts of the centre 35° and 40° C.; after two hours were marked 46°, 55°, 58°, 62°, 64°, and 67° C.

In the centre of the thick stratum of fat covering the ham the heat was 64° C.

4. Another ham, weighing 16 lbs., after two hours and a half's boiling, the centre part presented a temperature of 44½° C.; after three hours and twenty-five minutes it was 62°, 63°, 74°, 78½°, and 84° C. in different central points.

5. A third ham, of 14 lbs. weight, after three hours and twenty-five minutes' boiling, gave the following degrees of heat at different parts in the centre:—67½°, 73°, 74°, and 75° C.

6. A fourth ham, weighing 14 lbs., after three hours' cooking, was 51°, 59°, 61½°, 65½°, and 67° C. Ten minutes after the ham was taken out of the water; in the part where it was only 51° C. it was found to be 58° C. Near the middle part of the femur, it was 65½° C.; in the middle of the fat, 67° C. As hams are cooked for two and a half to three hours and a half, according to their size and weight, it is certain that cooked ham cannot transmit trichinosis.

7. A piece of rolled-up belly, weighing 500 grammes (or about 1 lb.), of a cylindrical form, after twenty-two minutes of boiling, in the centre was at 44° C.; after fifty-two minutes the temperature had risen in the middle to 87° C.

8. A belly-piece not rolled up, weighing 12 pounds, after an hour and a quarter's cooking, in the inmost central points, was at 66½° C. It is to be noticed that these parts are usually cooked for one or two hours from the time the water begins to boil.

9. Tongues put into the saucepan with the hams. Boiling point was reached only after an hour. Eight minutes' boiling having passed, the thickest muscular part of a calf's tongue was found to be 63° C.; after twenty minutes an ox-tongue (tried at the thickest part) was 58° C.; after fifty-five minutes' cooking, another calf's tongue was 89° C.; after an hour's boiling, an ox-tongue was 81° C.; and in another tongue, of about the same size, after two hours and a half's cooking, it was 90° C., in less than three minutes from the immersion of the thermometer in the thickest part. A pig's tongue, after an hour and forty-five minutes' boiling, had also 90° C. in the thickest part. Calves' and pigs' tongues are cooked two hours, ox-tongues two and a half to three hours, counting from the time the water boils.

10. In a pig's cheek, after an hour and three-quarter's boiling, near the eye I found the heat to be 90° C.

11. In the snout, after two hours' boiling, the heat was 96° C. Generally the head and snout are cooked for two hours; then the flesh is taken from the bones and put in a cloth, thus forming the brawn, which is then cooked for half an hour.

12. A *salame di testa* (brawn), after an hour's boiling, gave 86° C. in the centre portion. A second *salame*, made of raw meat, weighing 4½ lbs., 9 centimeters wide (3½ inches), after two hours' cooking was 83° C. in the middle. A third *salame*, over 4 lbs., made three months previously, was also in the centre parts heated to 83° C. after boiling two hours.

13. A sausage with garlic, 10 centimeters long (4 inches), and weighing 120 grm., 17 minutes after being put in boiling water, had internal heat of 65° C.

14. A piece of pig's lungs, after an hour and a quarter's boiling, notwithstanding the rapid cooking of so spongy a part, gave a heat of 86° C.

All these experiments show that the usual way of cooking, done diligently and carefully, is sufficient to raise the temperature beyond what is necessary to kill, not only the Cysticercus of the Tænia capable of lodging in the human body, as Cobbold has said, but also the Trichinæ, which, according to my experiments, would not resist the general law of heat, as I have shown for the majority of helminths parasitic in man and in animals.

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Preserving Confervæ and Desmids.*

The following solution has been found by P. Petit to be the best adapted for preserving the natural green color of the chlorophyllian Algæ (Confervæ and Desmids), it having occurred to him that success might be attained by applying to Algæ the process made use of in commerce for preserving the green color of vegetables.

The basis of the solution is "Ripart's fluid,"† and, by the addition of a copper salt, the tendency of that preparation to destroy the chlorophyll is overcome.

	gr.
Camphorated water	50·
Distilled water	50·
Crystallizable acetic acid	0·50
Crystallized chloride of copper	0·20
" nitrate "	0·20

Dissolve and filter.

Preparations made in this liquid have preserved the brilliancy of their green hue, even after a year's exposure to the full daylight. *Spirogyra*, *Ulothrix*, and above all, Desmids (*Penium Nægeli* and *Micrasterias crenulata*) have thus been preserved in all their freshness.—*Jour. Royal Mic. Soc.*

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* "Brebissonia," iii. (1880) p. 92.

†See Cornu and Rivet, "Des Preparations Microscopiques," Paris. 1872.

THE AMERICAN

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Important Notice.

We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II, III, and IV, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

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The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the American Journal of Microscopy. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

New Edition of Carpenter on the Microscope.

COPIES of the new edition of Carpenter on the Microscope are now in this country, in the hands of the binder, and ere this reaches the eye of the reader will be ready for delivery. The price of this edition is the same as that of the fifth, $5.50.

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Out of Print—How to Use the Microscope.

THE third edition of this book is out of print already. Orders came in so rapidly that an edition which we expected to last for a long time, has been sold in a few months.

There will be very little delay in getting out the fourth edition, as the changes and additions will be very slight. But the size of the book has now been so much increased since what it was when the price was first fixed, that we are compelled to raise the price to $1.00.

◆

Prof. Beale's Address as President of the Royal Microscopical Society.

THOSE of our subscribers who desire to read this valuable address will find it in full in *Science*. It appeared in two consecutive numbers, which may be obtained by sending twenty cents to "*Science*, Tribune Building, New York."

◆

Reports of Societies.

IT is greatly to be desired that the Secretaries of our different societies would send us their reports regularly. These reports are read eagerly by the members of sister societies, and serve effectually to keep alive the general interest. We publish them in full, and when they encroach too far on our general space, we are always willing to give our readers a few extra pages either in the same issue or in some succeeding one.

And when reports are sent, please have them complete. In some cases we receive reports which are unintelligible. A newspaper clipping which says: "Our Microscopical Society met last evening," may be very intelligible to the inhabitants of the town in which the paper is published, but it conveys no definite information to the readers of this journal.

Our Book Table.

American College Directory and Universal Catalogue: A Handbook of Education, containing the Name, Location, Names and Titles of the Presiding Officers, etc., of all the Colleges, Seminaries, Academies, etc., etc. St. Louis, Mo.: C. H. Evans & Co.

This is an 8vo. volume, of about 100 pages, the title of which sufficiently indicates its scope and object. Such examination as we have been able to give it leads us to regard it as reliable. Its utility is obvious.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Genesis of Chilloden Cucullus.

Ed. Am. Jour. Microscopy—You remember the microscope you sent to my little eleven year old boy, Willie. He makes discoveries with it that older heads have not, I think, made. Last year he gathered some ferns in a swamp, and laid them away to make infusions with, and, as he said, to see what he would get. He says that he gets different animalculæ from different places, and that these ferns would bring out animalculæ like those in the water nearest where they grew. After he had his infusion in order, and had began to examine it, he told me about the water being full of little discs, and for several days he was testing drops of it under his microscope. Finally, one day, he called out to me, "Papa, come here, I have found out how Chilloden is made." I looked and found, under a power of about 200 diameters, a large number of discs, about the apparent size of a silver five-cent piece. Each had a hyaline border, and was apparently composed of granular protoplasm. This substance was, in the one under observation, revolving quite rapidly. Soon I observed three radial lines, shooting across from the centre, dividing it into three equal triangular parts. The revolution in the discs ceased, and a revolution commenced in each triangular part.

This continued a short time, and suddenly the three parts separated, and began to swim about clumsily. Cilia could be seen moving languidly, and five minutes later, the acute angle of each had put on the crook-necked shape *Chilloden Cucullus*, and was sailing around full grown. Willie says that the discs sometimes, but not often, divide into four parts. This whole operation took only about ten minutes, and I watched several of the births of Chilloden which took place in the same way.

This, if new, is Willie's discovery, and it is a very interesting one. If any one else has seen it, I would like to hear of it.

S. A. WEBB.

Oswego, N. Y., May 21, 1881.

Van Heurck's Synopsis of the Belgian Diatoms.

Ed. Am. Jour. Microscopy—I have looked over the plates pretty carefully, and compared many forms, which I had in my cabinet, with the representations, and found them invariably not only correct, when using the same amplification, but of the utmost use and importance when trying to ascertain certain species. I may condense my opinion of the work, as far as seen, to this: It is a perfectly magnificent work, and no diatomist should be without it, in fact *can* be without it if he intends to know what he is about.

F. H. ENGELS, M.D.

Virginia, Nev.

Taper-Front Objectives.

Ed. Am. Jour. Microscopy—In "How to Use the Microscope," 3rd edition, p. 150, I have just seen for the first time the following: "Objectives with tapered fronts. When the objective has a very broad front and short working distance, as is the case with most objectives of high angles, it is impossible to illuminate the object satisfactorily with the bulls-eye condenser. To avoid this difficulty, several makers, *notably Mr. Swift, of London*, have narrowed the brass work of their fronts to the last limit, so as not to interfere with the illumination of opaque objects."

The facts are that Mr. Tolles was the first to do this for this purpose some ten years ago, at the suggestion of the late Edwin Bicknell. Many objectives of this construction were then made. Among the earlier ones was one for Prof. Markoe, of this city, who took it to London *and exhibited it to Mr. Swift and others in* 1872. The next edition of Swift's catalogue contained the figures and advertisement of *his* objectives for opaque objects.

Honor to whom honor is due.

CHARLES STODDER.

Volvox Globator.

Ed. Am. Jour. Microscopy—A word of personal experience, relating to the Volvox globator, of which very interesting descriptions and pictorials are given in the London "Micrographical Dictionary," Vol. I, p. 375, and in the AMERICAN JOURNAL OF MICROSCOPY, Vol. III, p. 10.

It is believed that a careful search for these rare and wonderful organisms, if made in the proper localities, would often prove successful, and would render the beautiful Volvox globator increasingly accessible to microscopists.

The volvox are most likely to be found in the quiet open ponds and streams. A year or two since I obtained an abundant supply of the Volvox globator from a pond on the hilly ground of East Somerville, Mass.

A few weeks since, I, through the kindness of a friend, received a plentiful supply of volvox, recently taken from a pond at Flagstaff Hill, in the town of Hull, Mass.

In the present month, on June 17th, I found a small pond on the side of a hill in the southeast portion of Brookline, Mass., the water of which literally swarmed with living volvox, and of the largest and best developed sort I had ever seen. I obtained as many as I pleased for myself and friends, and, feeling elated with my success, I returned 58 hours afterwards to the same spot, and, to my surprise, the volvox had all fled! not one was to be found.

A. C. PALMER.

Brookline, Mass., June 22, 1881.

Answers to Questions in Optics.

Ed. Am. Jour. Microscopy—Mr. Speyers answers, in the June number, page 119, are correct, with the following exceptions: The emergence into water in the first case is 31° 58′ (*not* 32° 2′). In the second case the angle in glass is 23° 49′ (*not* 23° 48′), and the emergence into water is 27° 27′ (*not* 27° 30′). Mr. S. takes the relative index of the water to glass at ·8743, with the glass at 1·525, and the water at 1·336 (as given by all the best authorities, the relative index is ·876). The portion of Mr. Reddots problem, in regard to reflection, can only be approximatively solved. Lardner (Optics, p. 59) says, "The law by which the quantity of light regularly reflected varies according to the density or other physical qualities of the media has not been ascertained. It is, however, certain that it depends upon the qualities of the medium from which the light passes, as well as those of the medium into which it passes." At p. 59 he gives Bouguer's table, showing rays regularly reflected by glass; incident light at 60° to be 112 per 1,000, and incidence 30° to 0° to be 25 per 1,000; assuming the reflection proportional between 0° and 30°, and also between 30° and 60°, and taking the value of the incident ray at 1,000, and neglecting fractional parts of a ray, we shall get:

Case 1, at 45° 1,000 — 69 = 931 } Loss say 9 per ct.
" 27° 37′ 931 — 21 = 910 }
Case 2, at 38° 1,000 — 48 = 952 } Loss say 7 per ct.
" 23° 49′ 952 — 19 = 933 }

In these calculations we ignore the light irregularly reflected, and absorbed at both surfaces. These would go to swell the loss. The reflected rays in Case 1, at emergence into water, will be reduced to 16, and those in Case 2 to 14; the reflections there being proportional to the refractive indices.

Other data or conditions might be assumed, but with the present state of physical science in regard to the matter, the results would be quite questionable.

CHR. C. BROOKS.

153 McCulloh St., Baltimore, Md.

Metric Scales.

Ed. Am. Jour. Microscopy—Added to the convenient tables for reference on the cover of the *Journal of the Royal Microscopical Society*, is a scale of centimetres and inches.

Having, recently, occasion to make use of this scale, I afterwards verified the work with my own office scale, purchased of the American Metric Bureau. Finding the results did not agree, I compared the two scales, and found a difference of 2 millimetres in 15 centimetres.

I find my scale agrees with that used as a standard in the Physical Laboratory at Cornell University, kindly compared for me by Professor Gage, who states that he finds the 6 inches of the *Journal of the R. M. S.* scale short by 1-20th of an inch.

As Mr. Crisp probably arranged his scale from some standard in England, it may be well, in the interest of scientific accuracy, to have this matter cleared up.

JOHN MICHELS, Editor of *Science*.

New York, June 10, 1881.

Blood Corpuscles.

Ed. Am. Jour. Microscopy—I perfectly agree with Dr. Waterhouse, in his letter to the June number of this journal, that truth is best developed by a sharp and unsparing controversy. For this reason I am glad to notice the revival of contention over "blood stains," a subject upon which I have my strong convictions, and convictions founded, not upon other peoples *arguments*, but upon my own experience.

As my last experiment was directly in line with the one proposed to Prof. J. E. Smith by Dr. Waterhouse, I think it may be worth while to give my results.

At my request, Dr. Wm. T. Smith, of Hanover, furnished me eleven numbered slides of blood from five different animals. Upon each of the slides, except No. 5, I measured 100 discs; on No. 5, 10. The most of my measurements were made with a 1-8th Crouch and B. eye-piece (1 inch), with E. P. micrometer, giving a magnification of 850 diameters.

In every case I distinguished correctly between human and other blood, and in almost every case correctly identified the animal. My results were as follows:

No. of Slide.	*Average.*	*Verdict.*	*Really.*
1	6·39μ	*Cat.*	Cow.
2	7·98	Human.	Human.
3	6·39	*Cat.*	Cow.
4	7·43	*Dog.*	Rat.
5	6·82	Rat.	Rat.
6	6·89	Rat.	Rat.
7	7·54	Dog.	Dog.
8	6·04	Cow or Horse.	Horse.
9	8·22	Human.	Human.
10	7·60	Dog.	Dog.
11	6·12	Cow or Horse.	Horse.

In my comparison of blood from the same animals, I expect a variation even between the averages of sets of 100; but rarely does this variation exceed ·3μ, a margin for which I am always prepared. The only slide in the above measurement that varies from its fellows by that amount or more, is No. 4. On this subject of variations in the same individual, and between individuals of the same species, I have made interesting observations, which I will communicate at another time.

Geo. O. Mitchell, Assistant in Physics.
Dartmouth College, Hanover, N. H., June 6, 1881.

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A Cement Wanted.

Ed. Am. Jour. Microscopy—Can you inform me which is the best medium for holding sections of minerals to the slide; is there any substance that will do as well or *better* than evaporated Canada balsam? It must be tough and also tenacious, so that the section can be ground and polished when it is attached to the slide.

F. W. McAllister.

Baltimore, June 24, 1881.

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Wax Cells with White Zinc Cement for Fluid Mounts.

Mr. W. H. Walmsley, of Philadelphia, points out that while much has been written regarding the use of wax cells for dry mounts, their eminent adaptability for fluid mounts has been strangely overlooked. His own use of them for this purpose has extended over a considerable period of time, and has given great satisfaction. In the matter of economy, ease of preparation, and durability, he considers the method adopted of considerable value. His chief reliance for the permanency of the cells rests upon the use of white zinc cement for coating the wax, the latter being mainly used for making the cells of various depths. Thirteen years' use of the white zinc cement, during which time he has prepared thousands of slides, has satisfied him of its entire permanence, while it is the most easily used of any cement, and its appearance is elegant on a finished slide. The only defect is that it turns yellow in time.

A ring of the cement is first made upon the slide with the turn-table. The wax ring is then added, and over the same successive coats of the cement are applied, allowing each to dry before another is added. After the last coat has been applied, and the cell allowed to dry for some time, the cement becoming hard in about a day, or even less time, a thin coat of the cement is now applied, after which the cell is filled with the mounting fluid, and the object is spread out and arranged properly in the cell. A thin glass cover must then be made to cover the cell in the usual manner, expelling the air, and it will adhere to the fresh cement all around. A spring clip is attached, the slide washed with clean water, using a camel's-hair pencil, then dried with a soft towel, when, after a time, another ring of the cement may be run around the cell, and the cell ornamented with colored rings. The fluids used have been glycerine both pure and diluted, carbolic acid water, and Goadby's fluid.

Mr. Walmsley recently forwarded to the Society several slides which he had prepared, and which appeared to be in every way excellent, and he has communicated the formula which he now uses for preparing the cement as follows:

One part (by weight) of mastic (tears) to 3 parts of gum dammar, dissolved in benzol. To 3 pints of this solution (about the consistency of cream) add 1 lb. of pure French oxide of zinc, ground in a small portion of linseed oil, and stir thoroughly. As the zinc will settle by standing, it should be stirred every time it is used, and if it becomes too thick to flow readily, add a little benzol.—*Jour. Royal Mic. Soc.*

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Fine Rulings.

Dr. R. H. Ward, of Troy, N. Y., writes upon the subject as follows:

"In speaking of the modern microscopic rulings on glass, which have been regarded with so great and deserved an interest by physicists, one cannot be too careful to discriminate fully between those that are known to be ruled and those whose ruling has been attempted, but not yet demonstrated. It is self-evident that, in attempting to rule lines 5,000,000 to the inch, a band may be produced which does not consist of lines of that degree of fineness. There is no difficulty in arranging a machine to draw lines, theoretically, of any required degree of closeness. The register of a ruling engine can be so arranged and subdivided as to indicate a spacing at the ruling point of one ten-millionth of an inch as easily almost as of one-tenth of an inch; but it may well be doubted whether such fine motion is actually imparted to the diamond point, or could be recorded upon the surface of the glass. It is becoming common to hear the higher bands of Mr. Fasoldt, claiming up to 10,000,000 lines to the inch, spoken of as actually ruled, and only waiting an objective to reveal them. Such an error, made inadvertently by persons who would avoid it by a little reflection, as made in the last number of one the most popular microscopical journals, gives a lasting as well as erroneous impression to non-scientific persons. Mr. Fasoldt's rulings are certainly remarkable, and the lower bands are ruled with great success; but how far up the scale they continue to be ruled as distinct lines is certainly at this time an undecided question."—*American Naturalist.*

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Current Notes.

A New Parasite.—At a late meeting of the Hertfordshire Natural History Society and Field Club, (England), Dr. A. T. Brett read a suggestive paper "On Fluke in Sheep, with remarks on a new parasite discovered in the muscular fibres of sheep who have the rot." His attention was first directed to this new parasite by Dr. Mann, the Medical Officer of Health for Pontypool, and Dr. Brett proposes to name it *Distoma musculum.*

Curiosities of Adulteration.—A schoolmaster sends the following singular statement to the *London Lancet:* "I am at the head of a town school, and a short time back gave Bread-making to a class of boys as the subject for an essay. One of the essays began in school-boy English:—'The first think in bread-making is to boil the potatoes, and then you must peel them and mash them carefully. Then you must mix them with a little water, and set them in a warm place till they begin to ferment,' etc., etc. Oddly enough, *flour* was not mentioned in the course of the essay. The boy's father is a baker."

Organisms in Water.—At a recent meeting of the Royal Microscopical Society, Mr. Joseph Beck suggested that good service might be done to the public if some of the Fellows would devote their leisure to the microscopical examination of the water supply of London. He felt that the present time was extremely favorable, owing to the public agitation on the subject, and he thought that it might be found that while the presence of certain organisms indicate purity, the presence of others would indicate the reverse. The subject has attracted a good deal of attention in this country, but it deserves more careful and elaborate work than has yet been given to it.

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Central New York Microscopical Club.—A regular meeting of this Society was held on the evening of Tuesday, June 28, 1881, at the office of Dr. Aberdein, in Syracuse. It being the meeting for the election of officers, the following were chosen: President, Geo. K. Collins, Esq.; First Vice-President, Alfred Mercer, M.D.; Second Vice-President, C. E. Slocum, M.D.; Treasurer, Robert Aberdein, M.D.; Secretary, A. L. Woodward. An adjournment was then taken until the last Tuesday evening in September.

Microscopical Section of the Iowa State Medical Society.—This Society met in the city of Dubuque on May 25th.

The President, Prof. J. J. M. Angear, delivered an extemporaneous address on the use of the microscope, showing that the microscope is one of the numerous instruments which medical men use to aid their senses—to carry the mind where it could not go without it. The scientific medical man could get along without the stethoscope or speculum as well as without the microscope. To show the work it has done, he asked us in our imagination to blot out all the knowledge which has come to us through the microscope. We should know no more of cell life and its wonder working power than the Hottentot does of the calculus. Ciliated, epithelial, glandular, and nerve cells: Take away our knowledge of these, on what would histology rest? The present medical science could no more exist without the microscopical revelations of the cells than the animal economy could be maintained without the cells. You may as well destroy the thing as to obliterate our knowledge of it.

What should we know of a nerve--axis cylinder, or neurolemma? The beauties of a muscle—its fibrillæ and sarcolemma would be as unknown as the shape and size of the elements.

Without the microscope the blood is simply a colored, homogeneous fluid, but with it, it is as much a living, moving community as a metropolitan city, with millions of independent beings—beings in infancy, in youth, adult and old age, in health and disease—its living and its dead corpuscles. The blood of the different species, like the individuals of different nationalities, to be recognized by peculiarities, contour of features, or size.

The microscope, in the hand of the skilled, aids materially in bringing criminals to the bar of justice, and, by superiority of skill, vindicates and clears the innocent, while the criminal is convicted and punished. It throws light upon dark deeds whereby the jury can clearly see facts, and the shafts aimed at the innocent are broken ere they reach their victim; and the garb of innocence is torn from the guilty, and the criminal appears before the tribunal covered with leprous spots of infamy and shame.

The Professor illustrated on the blackboard some of the appearances of the blood corpuscles; also Dr. Piper's method of diagnosing human blood. In all such cases the blood corpuscles, and not the m. m. m., should be taken as the unit of measure. If the corpuscles do shrink, as some claim, by drying, that is to the prisoner's advantage, and he cannot complain. The conscientious microscopist can rest assured that if he errs on account of the contraction of the corpuscles, he errs on the side of mercy, because he will be more likely to decide that it is not, when it is, human, than the reverse, which is impossible, because human blood corpuscles are the largest of the mammalian, except those of the elephant and the sloth.

There are microscopists who assert, not simply that they cannot diagnose human blood, but that human blood cannot be diagnosed, while others assert with equal boldness that it can, and that they have done it.

Dr. Wm. M. Eames, being anxious to test this matter, sent Prof. J. Ed. Smith some stains marked alphabetically (some of them were human blood, and some were not), requesting him to examine, and tell if possible which is human. Prof. Smith used 4,000 diameters and camera lucida, drawing the corpuscles on paper. When he had concluded his examination he went before a notary public and swore that the specimens marked *f* and *i* are human blood, and forwarded the same to Dr. Eames. Dr. Eames wrote Prof. Smith: "Your report of the examination of specimens of blood stains I sent you is received. Much to my surprise you have made no mistake in regard to any of the 9 specimens submitted. The 2 marked *f* and *i* are, as you pronounced them, human blood."

Hereafter we hope those who have been protesting so loud and long that human blood cannot be diagnosed will be a little more modest, and simply say *I* cannot diagnose human blood.

He spoke of the importance of being familiar with common things, such as cotton, linen, silk, wool, hair, etc., because the proof of their presence in blood may be of vital importance.

The Doctor closed by giving some illustrations on the blackboard, and making some remarks on the detection of forgery by the microscope.

A number of microscopes with anatomical slides were on the tables during the entire session of the Medical Society.

Among the microscopes there were Beck's, Crouch's, Bausch & Lomb's, Nachet's, Zentmayer's, etc.

Dr. McIntosh, of Chicago, entertained the Society for an hour on the morning of the second day with his improved solar microscope.

Prof. J. J. M. Angear, of Fort Madison, and Prof. W. D. Middleton, of Davenport, were re-elected President and Secretary.

The Section adjourned to meet at Des Moines the last Wednesday in January, 1882, at which time and place the Iowa State Medical Society meets.

Wellesley College Microscopical Society.—At the close of the college term (June 8th) this Society gave an exhibition which did great credit to the members. A very large proportion of the exhibits consisted of the original work of the members. It is not often that we find an exhibition presenting the same scope as well as thoroughness of execution. The following is the programme, which we give complete, as a model for others:—

1. Anatomy and histology of Cray-fish (Astacus fluvialis), with drawings prepared by Flora B. Mussey. Living specimens; Liver cæcum, stained, one-tenth objective; Eye, vertical section; Ear; Appendages arranged, etc. 2. House-fly (Musca domestica), with drawings prepared by M. P. Waterman. Entire insect; Organs in situ; Trachea; Eye; Foot; Different Stages in development of Fly. 3. Embryology. Objects prepared by Emily Norcross. Living embryo of snail; Sections of same, one-eighth objective; Embryos of chick. 4. Miscellaneous objects prepared in Biological Laboratory. Structure of Kidney, drawings by Alice Leonard. Vessels and Malpighian Corpuscles injected; Convoluted uriniferous tubules; Straight tubules. Circulation in frog; Circulation in Triton. Amœbæ. Injected muscle. Skin showing sudoriferous and oil gland, hair sac, hair muscles. Retina of human eye. Skin of Synapta, showing anchor-shaped spines. 5. Molds with drawings prepared by S. Adelaide Wells. Spores of Penicillium; Sprouting Spores; Further stages of development. 6. Living specimens under microscopes. Campanularia; Tubularia; Hydractinia; Eudendrium, etc. 7. Structure of Bracken Fern, with drawings by Alice G. Egerton. Transverse section, low power; Transverse section one-fourth objective; Leaf, etc. 8. Cell structure, with drawings by T. A. Painter and M. E. Whipple. Circulation in Nitella; Pitted vessels in Nerium Oleander; Scalariform vessels in Osmunda; Medullary rays in stem of Mahogany, etc. 9. Mosses prepared by L. F. Clark. Barbula unguiculata; Funaria hygrometrica; Mnium. Parts shown, Peristome, Capsule, Operculum, Leaf. 10. Reproduction of Ferns, with drawings prepared by Hattie E. Emerson. Prothallus with Antheridia and Ar-

chegonia; Sori and venation of Polypodium vulgare; Sporangium of Aspidium marginale; Slides showing sori and sporangia, mounted by Miss Painter. 11. Pollens, prepared by Laura Jones. Pollen of Abutilon, of Asclepias, of Viola tricolor. 12. Grasses prepared by Marion E. Sheldon. Wild oat grass, Danthonia Spicata; Velvet grass, Holcus lanatus; Sweet vernal grass, Anthosanthum odoratum. 13. Anatomy of flower, with drawings prepared by Lila E. Watrous and M. G. Tyler. Vertical section of flower; Cross section of ovary; Stamens; Pistil; Varieties of placentation of ovules, and of dehiscence of stamens. 14. Rock sections, with drawings by Misses Roberts, Kitchell, and Hurll, shown with microscope by Fuess, of Berlin; Pitchstone from Arran, Scotland; Amygdaloidal Melaphyre from Saxony; Leucitophyr from Rhenish Prussia; Crysolitic Basalt. 15. Sections of Crystals shown by the Polari-microscope, by Hoffmann, of Paris. Sections of quartz showing hyperbolas, Sections of quartz showing fringes, Section of Iceland Spar. 16. Crystalizations shown with polariscope, Plumose Quinidine; Quinate of Quinine. 17. Absorption bands shown with the Sorby-Browning Micro-Spectroscope, with drawings of spectra by Belle French. Oxalate of Didymium; Oxalate of Uranium; Solution of Carmine compared with solution of Blood. 18. Miscellaneous objects exhibited: Dr. Seiler's sections of Adult larynx, through vocal cords, through ventricular bands, through Ary-epiglottic folds. Crystalized Gold, shown with Binocular. Dalton's group. Multiple image in eye of Beetle. Isthmia parasitic on Algæ, shown with parabola. Lord's prayer written with diamond in 1-1800 of an inch, shown with one-tenth objective. Micro-photographs, Melrose Abbey, Tintern Abbey, shown with one-half objective. 19. Apparatus used in mounting and methods of mounting exhibited by Alice Gold. 20. Methods of Micrometry, exhibited by May Merrian. Method with the Camera-lucida, and stage micrometer; method with Jackson's eye-piece micrometer. 21. Books, periodicals and collections of the Society.

San Francisco Microscopical Society—Ninth Annual Reception.—Never before in the history of the Society's receptions has so large and brilliant an assemblage filled its hall on reception night as gathered in Mercantile Library Hall on Friday evening, May 6th. Thirty first-class microscopes were in position, and a series of objects exhibited, selected from the various departments of nature, which were instructive as well as amusing and interesting. The room was well filled, and the crowd around the instruments so great that politeness kept many gentlemen from fully enjoying the novel sights. For the satisfaction of those who could not see them all, and the instruction of those not present, we will endeavor to describe, as briefly as possible, the objects exhibited at the several tables.

DIATOMACEÆ.—Table No. 1 was c
Mr. William Ashburner, one of th
dents of the Society, who exhibite
algæ, with diatoms in situ." The
belong to the family of confervoid
inhabit marine and fresh water; but
peculiar to the one are never found
state in the other. They are foun
abundance and variety in district
marine influences, such as marsh
rivers, in fact they seem to be ubi
there is hardly a road-side ditch, w
or cistern, which will not reward a
furnish specimens of the tribe. P
berg affirmed that their multiplicat
ercised an important influence i
up harbors and diminishing the
channels. In a fossil state the
skeletons compose whole mountai
sold by the ton for polishing pur
fessor Huxley asserts that it took
years to form an inch thickness of
tons on the bottom of the sea; th
measuring the height of a mount
by their shells, a "lightning calcu
estimate how many years passed
skeletons were forming the moun
Mr. Ashburner's objects, compose
silicious skeletons, were arranged
grams and stars, as well as those rece
which were in situ.

GOLD.—Mr. Melville Attwood, a
2, exhibited some beautiful roc
under the microscope, containing th
metal around which the indust
moves—gold. The cabinet speci
rock sections, and the metallic
rolled gold, were shown by Mr.
represent the two geological ages o
mation. They were very different i
fineness, from dark gold-yellow to n
white, and from 880 to 960 fine. G
in rocks of various ages, from the
Azoic to the Cretaceous or Tertia
The schists that contain the aurife
were once sedimentary beds of cla
mud, derived from the wear of p
rocks. Through some process, in
was concerned, the latter were meta
into the hard crystalline schists, a
same time upturned, broken, and of
between layers. Schists with aurife
veins, were also made in Paleozoic
later in the Jurassic period, as in
Nevada; and still later in the Creta
Tertiary period, as in the Coast M
California. Auriferous quartz veins
case *igneous* veins—that is, veins fi
jection of melted matter from below.

VEGETATION.—Mr. Chas. W. Ban
at Table No. 3, and showed some
specimens of the sporangia of ferns.
the spores set free by the bursting o
exhibited the strangely beautiful, t
contents, and brought to mind wh
and invisible beauties fill the world
seen. The peristomes of mosse
higher cryptogami were also shown

few are aware that under the microscope the commonest ferns which are found in every hedge and cañon, furnish objects of no less beauty than those yielded by the rarest exotics; and it is a valuable training to be taught how to look for beauties in the most familiar specimens of Nature's handiwork. One fresh specimen of pteris (brake-fern), brought from San Rafael the same day, gave great pleasure to the ladies, it being in fruit and especially beautiful. The moss capsules were also very pleasing and curious.

INSECTS.—Table No 6 was presided over by S. W. Dennis, the President of the Society, with four microscopes in position. The "living flea," one of his objects, is a creature in which all Californians are interested. When looking at him, "distance lends enchantment to the view." The creature looks well under glass, where we wish he could only be seen.

The acari (cheese mites), which were also shown at this table, are admired by the lovers of old cheese, but are of no particular interest to the writer, because the flavor they add to that product of the dairy is not relished by him. The tympanum, or drum of the frog's ear, was a curious and remarkable object; in fact, as studies, the objects at this table were all interesting, but not agreeable to the housekeeper. One object, a section of a rat's jaw, with teeth in situ, was very wonderful, and, as a transparent object, shown with fine effect. But the finest and most interesting object of this table was the "sting of the honey bee," (apis Mellifica.) This object is a contradiction of that nice proverb, which we transpose, or change, by observing that "a thing in hand is not worth two in the bush." The lancet (as it is termed) of the bee, is thus named because of its resemblance to the surgical instrument of that name, and is connected with a valve which forces a poisonous fluid through the opening in front of, and made by the lancet. The pain of the sting is entirely due to this poison. The lancelet is double throughout its entire length, terminating in an extremely thin cutting point, and with deep, recurved teeth, so that in many cases the sting cannot be withdrawn, and the insect escapes leaving it in the wound. The series of slides shown by Dr. Dennis, illustrated this wonderful apparatus of the bee for its defence, and each was fully and understandingly explained by the exhibitor.

At No. 8 stood Jacob Z. Davis, Esq., who exhibited some parasites of bat, bumble-bee, etc. Those poor creatures are to be pitied, if infested by these horrible animals. It seems necessary, in the economy of nature, that some horrible creature should prey upon us, and even the parasite has its parasite. So it is, the larger prey upon the smaller, and the smaller "get even" by sucking the blood of their larger enemies. We left Mr. Davis' table with an uneasy, crawling sensation, which his politeness could not entirely overcome, and thought to find something soothing while looking at the circulation of blood in the frog, at Table No. 16, which we will endeavor to describe.

CIRCULATION OF BLOOD.—The table was occupied by S. M. Mouser, M.D., and upon it the circulation of blood in the frog was seen. This wonderful spectacle was successfully shown; sometimes the current of blood would seem nearly or altogether stagnant, the movement re-commencing again after the lapse of a few minutes, although no change had been made in the external conditions. The movement of the corpuscles, which course one after another through the net work of capillaries that intervenes between the smallest arteries and the smallest veins, in those tubes which pass most directly from the veins to the arteries, the current is always in the same direction; but in those which pass across between these, it may not unfrequently be seen that the direction of the movement changes from time to time. The red corpuscles flow at a very rapid rate along the centre of each tube; the white corpuscles, which are occasionally discernible, move slowly in the clear stream near its margin. The satisfaction derived from this spectacle was not exactly what we thought, and our nervousness was not all diminished by knowing that similar fluid was running through our own veins and arteries with the same rapidity, and turning toward the opposite side of the room, we walked toward the table occupied by C. H. Dénison, the Secretary, thinking from the programme that something similar to the decorative art (not de-cor-a-tive) was to be seen. We were aware that the spectacle of the circulation in the tadpole must be examined, and desiring to recover from nervousness before commencing it, we thought to look on some "fancy piece" for a time, on Table No. 7.

A UNIQUE BOUQUET.—We knew also that Denison had "traveled" a little; that he had seen the cartoons at Hampton Court, and had paced the grand *salon* of the Louvre and counted the paintings on each side; therefore that something to dispel nervousness would be found on his table. And our confidence in his esthetics was not misplaced. He had on exhibition a beautiful tiny bouquet in colors, composed or formed of the scales and hairs of butterflies, beetles, moths, and selected diatoms. These brilliant elements were grouped to represent a beautiful bouquet, which represented fern leaves and other plants. The fern leaves were made of the scales of the diamond beetle, from Brazil. The bouquet was made by the artist while looking through the microscope, and was the most brilliant object ever before exhibited under the microscope in California. Mr. Denison also exhibited among other diatoms, a specimen of a very rare one, known as Licmophora Flabellata. In this family the frustules of the diatom are wedge-shaped; in some genera they have transverse markings, whilst in others these are deficient; but in most instances there are to be observed two longitudinal suture-like lines on each valve. The frustules remain coherent, but increase gradually in breadth, so that a beautiful fan-like arrangement is produced. The plant, or parasite, looks like a bundle of fans growing upon the summit of the branches of a tree. This beautiful and curious diatom is marine, and is parasitic upon sea weeds and zoophytes. The diatomaceous earths shown at this table gave increasing zest and interest to the exhibition of fossil diatoms they contained.

Relations of the Circulating Systems.—Table No. 18 was occupied by Mr. George H. Williams. Mr. Williams had on exhibition the tadpole, and the observers enjoyed the gratification of witnessing a most wonderful spectacle, giving a very acute idea of the relations of the different parts of the circulating system, not alone of the capillary, but the general circulation. The changes which accompany the metamorphosis of the tadpole are too lengthy for this article. But those who saw the creature under Mr. Williams' microscope, looked as through a pane of glass, into the chamber of its chest. In front was the beating heart, a bulbous-looking cavity, formed of the most delicate, transparent tissues, through which are seen the globules of blood, perpetually, but alternately, entering by one orifice and leaving it by another. The heart appears to be slung, as it were, between two arms, or branches, extending right and left. From these trunks the main arteries arise. The heart is inclosed within an envelope, or pericardium, which is, perhaps, the most delicate, and is certainly the most elegant, beauty in the creature's organism.

Miscellaneous.—Mr. H. G. Hanks showed at Table No. 9 starches, fossil-fish scales from the coal-oil shales of Santa Cruz county, and fossil shells, of which the soil of the Colorado Desert is largely composed. These last were of greater interest because of the fact that the desert is more than 200 feet lower than the outside sea, and must have quite recently (geologically speaking) been under water.

At Table No. 10 George C. Hickox presided with some fine instruments and an antique one made fifty years ago. Mr. Hickox showed some resplendent crystals of gold, cinnabar and azurite, the latter with tabular crystals finely terminated.

Mr. J. A. Langstroth exhibited the ova of the water snail, showing the first movements of life, and at Table No. 17 Mr. Warren F. Myers had under his microscope a piece of the sea mussel, showing the ciliary motion. Among animalcules the action of the organs termed cilia has a very important connection with the vital functions. They are always found connected with cells, and are seen in the crustacea in animals and vegetables. When in motion or full of activity it is like a current or motion of a tiny whirlpool, and the motion continues for hours after the cilia are taken from the animal. Around these tables the visitors crowded, attracted by the novel sights.

J. H. Wythe, M. D., showed by the aid of a splendid instrument of Zentmayer's make, the beautiful and gorgeous series of objects under the polariscope, or by polarized light. The platinoc-yanide of magnesium was a wonderfully beautiful object.

E. H. Woolsey, M.D., showed at Table No. 20, adipose tissue cells of the liver and cornea. Here one could well answer the question asked by the writer of a book entitled "Is Life Worth Living?" We answer: *It depends upon the liver.*

Mr. W. G. W. Harford showed some extremely beautiful sectional slides of fern stalk, Pteris aquilina, longitudinal section of wood and club moss.

Having as briefly as possible enumerated and described the objects shown at this reception, we may be excused if we remark (and the reader who may have been present will sustain our declaration) that it was a remarkably successful and brilliant reception, and we heartily wish there were more societies who were willing to hire a hall, pay expenses, and give all the tickets to the public. We say with great satisfaction: "Long live the San Francisco Microscopical Society!" Let the reader say, "Amen!"

Microscopical Society of Canandaigua, N. Y.—A regular meeting of the society was held at the residence of Dr. N. T. Clarke, on Tuesday evening, May 10, 1881. The society was called to order at half past eight by the president, Dr. Clarke, and the minutes of the last meeting were read and approved. The following members were present: Dr. N. T. Clarke, Miss Dr. Howard, Dr. and Mrs. H. F. Bennett, Miss Slocum, Dr. Mitchel, Dr. Hallenbeck, Rev. Mr. Hiscox, and Dr. J. Jewett.

Upon solicitation of Miss Dr. Howard in behalf of the society, Mr. Griffith, of Fairport, kindly consented to entertain the society with a description of some of the methods of mounting specimens for the microscope.

Mr. Griffith being very expert in that department of work, the members present enjoyed a rare treat and obtained much useful information.

The mounting of opaque objects was first discussed. The simplest form of cell for this purpose is the wax cell, which is easily made by cutting a circle from common sheet wax with a thimble, pressing this on the glass slide, and then laying upon it an ordinary brass curtain ring. Over this is placed the cover glass, and if the specimen has been placed on the wax background of any color desired, the result is a permanent and beautiful slide. The glass cover is best cemented to the ring by a solution of gum shellac in absolute alcohol. In this way many specimens of seeds, sands, crystals, and other objects can be prepared which are really beautiful. If it is desired to make the cell more shallow, the curtain rings can be readily flattened by a flat iron. Gutta percha rings can be used instead if prefered. The Atwood cell of hard rubber is a very convenient one and can readily be fastened to the slide. These are made by Bausch & Lomb, of Rochester.

In mounting specimens in balsam or damar, it is well to make one's own balsam by dissolving the gum in benzol. When it is dissolved, it can be filtered through cotton in a glass tube. The use of the turn-table in ringing cells was fully illustrated by making borders of various colors. The use of common tube paints dissolved in drying oil was strongly recommended for giving a handsome border to objects mounted in balsam and other specimens. These are excellent for fastening a cell to a slide also.

Some remarks were made in regard to the gathering, cleaning, and preserving of diatoms, and several slides were prepared in illustration. To destroy the organic matter preliminary to mounting, the diatoms are heated to a red heat upon a piece of tin type over a spirit lamp.

A beautiful slide, representing various flowers tastefully arranged and made from the scales from a Brazilian beetle, was exhibited. This was made by Mr. Griffith himself, and the way in which it was done by means of the mechanical finger was of great interest to all present.

Mr. Griffith also exhibited a portable microscope devised by himself, which was of large size when extended, but capable of being packed in a very small compass.

Refreshments having been served a vote of thanks was extended to Mr. Griffith for his kindness in coming before the society.

The name of the Rev. J. H. Lee was proposed for membership, and he was accordingly elected.

On motion, the society adjourned to the second Tuesday in June, to meet at Dr. Carson's. Dr. Hallenbeck was appointed to read the paper. J. H. Jewett, Secretary.

Camden Microscopical Society.—At a regular meeting of the Camden Microscopical Society, among the many matters of interest discussed was that of the *Cecidomyia Leguminicola*, an insect which depredates upon clover. In relation to this insect Mr. Louis T. Derousse, an earnest and intelligent entomologist, read a valuable and interesting paper from which extracts are here given.

The writer disclaimed any originality in the discovery of the insect, which was first noticed in this country about thirty years ago, but states that a short time ago Wilson Fitzgerald received a lot of clover seed from Northern Pennsylvania, and while he, the writer, was making an examination to detect faulty seeds, he discovered by the aid of the Microscope a number of yellow looking objects, which upon examination resembled a larva of some kind. Further scrutiny proved them to be orange colored larvæ, and in large quantities. Believing it to be of importance, some of the seed was sent to A. S. Fuller, entomologist of Ridgewood, Bergen County, who in answer wrote as follows: "I will say that on further examination I am confident that the clover seed insect sent me is the *Cecidomyia Trifoli* of Lintner, and is closely allied to the Hessian fly and the wheat midge, all of which and numerous other species belong to the *Diptera* or two winged flies and family Cecidomyia. The females deposit their eggs on the seed while in the clover head in the field. When the clover is ripe and falls down in Autumn, the larvæ crawl out, enter the ground, and remain there to finish or complete their transformation, coming forth as flies the following season. But if the clover seed is gathered or the hay cut, the grubs and pupa are also gathered, and while most of them will be killed in hulling the seed, still a few may escape destruction. Heating the seed or violently shaking it in some kind of a mill, would probably be the most expeditious way of destroying the grubs and pupa. If the seed be placed in tight barrels with a little gum camphor or pure benzine, it would kill the insect and not injure the germs of the seed. Farmers should look to this matter and see that all insects in their clover seed are destroyed before putting it away in the fall or sending it to market."

A sample sent to Professor C. V. Riley, of Washington, the United States Entomologist, brought a similar reply. He calls it the *Cecidomyia leguminicola Lintneri*, and speaks of it as very destructive, and says, "If the injuries of the insect should become serious the clover seed raiser will be obliged to abandon for a series of years the growth of this crop, as in no other way are we likely to be able to prevent the multiplication of the enemy."

The writer of the paper goes on to say, "You will note the danger to this very important crop should there be an invasion of this insect like that of the dreaded potato bug. It implies, therefore, that a continual watch must be kept to guard against any sudden outbreak. Imagine the result of sowing this seed. Whilst the farmer would be sowing the seed he would at the same time be sowing the larvæ of the insect, which, when matured, would destroy his crop, for which no explanation could be given. As a class, the farmers—thrifty, hard-worked, persecuted, as it were—have it in their power to partially correct many of the evils to which they are subject. How few of them, however, trouble themselves as to what that ugly worm will be and what it may do, and many other important facts relating to the nature, origin or effect of the insects coming under their notice every day. On the contrary, they are apt to ridicule the entomologist as a "crazy bug hunter."

Professor J. A. Lintner, State Entomologist of New York, very caustically refers to this disposition of farmers to ridicule researches of the 'bug hunter" as he calls him, without stopping to consider the vast importance to himself of the researches of such scientist. I would particularly enjoin upon the Granger organizations the importance of disseminating knowledge appertaining to entomological study, and thus diffusing among the individual members a rational desire to bring to their notice facts which he may have observed, seemingly of no importance because of such common observation by him, but which collectively would lead to further investigation in the field while at work, and result in the extermination of enemies he knew not of. The farmer whilst plowing discovers larvæ, a caterpillar, or a moth, but passes it by as unworthy of notice, fit only for "The bug hunter." What is it to him, as to its origin and destination? But let his crops become infested with insects, and Paris Green, London Purple and other deadly poisons are purchased, entailing extra expense or increased labor. This, year after year, soon wearies the hard worked tiller of the soil, and he longs to lay aside the plow and seek other occupation, when in fact, if intelligently pursued, no avocation offers greater chances for enjoying an independent livelihood. In conclusion, it is unnecessary to say that the seed spoken of was returned to whence it came.

New Jersey State Microscopical Society.—This Society held its annual meeting May 16, in the Geological Hall of Rutgers' College. The Recording Secretary laid on the table printed copies of the new constitution and by-laws. The Society being just ten years old, the Secretary read a report, which was really a history of the Society. A number of members were ordered dropped for non-payment of dues. The following officers were re-elected: President, Prof. F. C. Van Dyke; Secretary and Treasurer, Rev. S. Lockwood, Freehold, N. J. It being the closing meeting of the year, a large amount of routine business was got through, but little time being left for exhibition of slides. The Secretary showed a mount of the pollen of the plant he had discovered as new to the Flora of New Jersey, *Mertensia Virginica*. He said, that excepting a few forms the two prevailing typical forms of the pollen grains of flowers might be called the elongate, or ellipoidal, like a grain of wheat, and the round or spheroidal. As illustrating the first, he showed the pollen of *Linario cymbalario*. The pollen of *Mertensia*, was double-headed, or dumb-bell shaped. Both pollens shown were very minute in size.

S. Lockwood, Secretary.

Fairfield (Iowa) Microscopical Club.—The Fairfield Microscopical Club held its regular monthly meeting at the residence of Prof. McCalla, on the evening of April 22nd, 1881, and was well attended by the members and a number of visitors. Prof. Lighton was appointed to prepare a paper on Microscope Objectives for the next meeting. Prof. McCalla read an interesting paper on "The Laws of Light and their Relation to Microscopy."

The topic was handled in a clear and comprehensive manner, and finely illustrated by figures and drawings. The arrangement of lenses in the construction of the microscope, was fully explained, which was especially instructive to the Club. After some questions and discussion on the lecture, the Club spent the rest of the evening in examining the various objects of wonder, and interest. The Club then adjourned to meet at the residence of Dr. F. L. James, May 20th, 1881.

D. H. Worthington, Rec. Sec.

EXCHANGES.

Good uncleaned diatomaceous material, containing Arachnoidiscus, Heliopelta, Triceratium, Isthmia, Pleurosigma, Surirella Gemma, and Terpsinoe Musica, wanted in exchange for well-mounted slides of arranged diatoms, etc., or cash. Danl. G. Fort, Oswego, N. Y.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, England.

A Baker stand, also a new imported $12 Zither, to exchange for first-class objectives. Box 107, Astoria, L. I.

The Lathe and Its Uses, etc., for a Nobert plate or a Micrographic Dictionary. E. Pinckney, Dixon, Ill.

Wanted, a foreign microtome in exchange for a C clarionet, in good order and worth $35. T. S. C., Asylum, Toronto, Canada.

Wanted, diatomaceous deposits (about a bushel of each kind, by express), for good slides, material, or cash. Geo. B. Scott, Box 4,196, New York.

Wanted, a second-hand microscope with powers of 50 to 350 diametors, price $10 to $35; will give books and chemicals; for list address A. Meyer, Cogan House P. O., Penn., describing microscope and accessories.

First-class slides, palates of marine molusca, and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens; lists exchanged. Rev. J. D. King, Edgarton, Mass.

Will exchange mineral specimens of Idaho for such books, minerals, curiosities, etc., etc., as I desire; Household Microscope wanted; state what you have to exchange, giving particulars. J. P. Clough, Junction, Lemhi Co., Idaho.

Selected and well-mounted diatoms, in exchange for other goods, slides, or material, etc. W. H. Tivy, 6th and Olive Sts., St. Louis Mo.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., caro Editor this journal.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving P. angulatum, will be exchanged for a first-class spectroscope, Clarence L. Speyers, 50 W. 17th St., N.Y.

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A New Mechanical Finger, Adapted to Microscopes having the Fine Adjustment upon the Nose-piece.

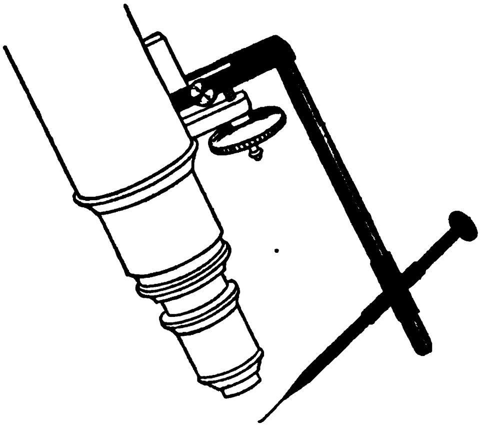
BY C. HENRY KAIN.

IN the AMERICAN JOURNAL OF MICROSCOPY for May, 1879, Prof. H. L. Smith describes a mechanical finger of simple construction, and gives such plain directions for its use that even a beginner can scarcely fail to understand its application. In the arrangement described by Prof. Smith, the most inconvenient part was the loosening and tightening of the objective for the purpose of focussing. It seemed to me that this could be avoided, and if a finger were invented that could be operated entirely by the adjustments of the microscope itself, it would be much more convenient and also much steadier than any other arrangement—steadiness being one of the first requisites of a good finger. At my suggestion, Messrs. James W. Queen & Co. constructed for me a finger, an engraving of which is given below. For steadiness, and ease of adjustment and manipulation, I think it leaves little to be desired. It is also quite inexpensive. My instrument is a Crouch's Students' Binocular, but the finger is just as well adapted to all microscopes that have the fine adjustment upon the nose-piece.

A glance at the engraving on the next page will, I think, render the working of it intelligible to all who read Prof. Smith's admirable article. It consists essentially of a slotted bar which may be firmly clamped to the upper (immovable) bar of the fine adjustment by means of a milled-headed screw. Through the end of this is fastened a round rod, at such a distance from the objective that, when lowered, the end will not strike the stage. Over this rod slips a split tube, to which is soldered, at an angle, a smaller tube. Through the small tube passes a rod carrying a glass hair at its extremity. This rod is easily rotated by means of a milled head. The capillary glass thread is attached to the extremity by means of beeswax. The arrangement of split tubes was suggested by Mr. Edward Pennock, to take the place of a binding screw which I had intended; it is a very neat and convenient affair, and much less clumsy than the arrangement I originally proposed. It will be noticed that the finger has no revolving collar, as it is quite unnecessary, especially when the microscope is provided with a revolving stage.

By dispensing with the revolving collar and making all movements depend entirely upon the adjustments of the microscope, greater stability and accuracy in working are secured.

To use the finger, the point of the glass thread is first brought into the focus of the objective, or nearly so, by sliding the tube on the vertical rod and pushing or pulling the rod carrying the glass thread until the desired position is attained. It is not difficult to do this, and, having once been done by hand, it does not have to be repeated, as all further movements are made by the adjustments of the microscope. Supposing now the point of the glass thread to be in focus; by means of the fine adjustment throw the focus *ahead* of the point, then, by means of the coarse adjustment, rack down and search for the object you wish to pick up. Having found the object desired, again bring the point of the thread into focus by means of the fine adjustment; then rack down with the coarse adjustment and pick it up. Now rack back with the coarse adjustment, remove the slip on which the material is spread, and place your prepared slip or cover upon the stage. Again, by means of the fine adjustment, throw the focus ahead of the object, rack down with the coarse adjustment and search for the spot where you wish to deposit the object, and, having found it, again focus the object, then rack down with the coarse adjustment, and, when the object touches the slide and has been placed in proper position, fix it by means of a very gentle breath. I prefer this mode of fixing instead of the arrangement of tubes proposed by Prof. Smith.



A NEW MECHANICAL FINGER.

I coat the surface of the cover or slide upon which the diatoms are to be fixed with an exceedingly thin film of gelatine prepared thus:—Dissolve 2 drachms of Cox's gelatine in 10 drachms of acetic acid by the aid of a gentle heat. When the gelatine is thoroughly dissolved, add 1 drachm of alcohol and 1 oz. of distilled water; stir well until thoroughly mixed, let stand some hours and filter through the finest filtering paper. Keep in a glass-stoppered bottle. To coat the cover or slip I dip a small needle in the solution and wipe it once flatwise across the glass.

There are many little wrinkles which the worker will acquire from time to time. One of the most important of these is the art of using the finger as a lever for moving diatoms or other objects into position when very slight movements are necessary. To do this, move the slide by hand until the point of the finger is just behind the object to be moved; then, by racking down with the coarse adjustment, the glass point pushes the object ahead of it. By a succession of pushes the object may be moved into any desired position. The coarse adjustment may be used in a similar manner for turning diatoms on edge or upside down by pushing them against some fixed object and forcing the glass point under them. By using a point rather firmer than usual, the valves of a diatom may be separated. To do this I usually fasten the diatom on a slide which has been coated with gelatine, and, when it is firmly fixed, the upper valve may be punched off without much difficulty. I have been able, in this manner, to verify the observations of Hon. J. D. Cox, recorded in the same number of the journal referred to at the beginning of this article, in reference to *Surirella craticula*, being a plate of *Navicula cuspidata*.

Another wrinkle, and quite a valuable one too, is what might be called a scientific use of the imagination. Many cannot work a mechanical finger well without an erecting eye-piece, on account of all movements appearing to be reversed. This difficulty will disappear if the worker will just imagine, as he holds the stage and moves it, that he is holding the *finger* and moving *it*. All motions will then appear to be perfectly natural. I might state here that a mechanical stage is not the best for this kind of work.

There is a popular misconception in regard to the mechanical finger which it may not be amiss to mention. Many regard it as a kind of scientific plaything—an instrument used merely for arranging diatoms so as to form pretty slides. I have no doubt but that it will come, eventually, to be regarded as one of the microscopist's most valuable accessories, and one which every worker will require. It may be used not only in handling and studying diatoms, but also other objects which are too small to be handled in the ordinary way. In studying the infusoria, for instance, a drop of water containing them may be placed in a concave slide, then, when the water has been almost evaporated, or has been removed by means of bibulous paper, the infusoria may be picked out with the mechanical finger and studied or deposited on a slip for mounting. A firm thread of dark-colored glass is best for this.

In studying diatoms a mechanical finger is almost indispensable, for it may safely be said that one is not thoroughly acquainted with a diatom until he has turned it over and viewed it in all its aspects. In mounting diatoms for study it is well to mount a number of the same kind in various positions so as to display the various spines, undulations, or other peculiarities. How often it happens, too, that in a mixed gathering of diatoms—and it is not easy to obtain pure gatherings—we find a rare frustule which we would like to preserve. By means of a mechanical finger the frustule may at once be selected and mounted. I am in the habit of keeping, in a tight box, a number of covers ready prepared, and when I come across a strange diatom I at once select it and mount it. The covers are prepared as follows: Take an ordinary glass slip and place a small ink spot upon it at or near the centre. When dry, place a tiny drop of balsam, not larger than the head of a pin, upon it and heat so that it will harden somewhat on cooling. Then drop a clean cover upon the balsam and move it until the ink spot is directly under the centre. When cool, coat the clean surface of the cover with the gelatine solution and put the slip away for use. I usually mount a dozen or more diatoms in a row on one cover, keeping a memorandum of the locality where each was found. When ready to mount, a slight heat—and it should be only slight for fear of charring the gelatine—detaches the cover, and it may then be mounted in balsam in the ordinary way.

When one wishes to arrange diatoms so as to form symmetrical figures, an eye-piece micrometer will be found very useful, not only in selecting diatoms of uniform size, but also in determining their position. A circle ruled in squares and used in the same way as the eye-piece micrometer will be found still more desirable.

It is a good idea to keep a number of glass points, of different degrees of fineness, ready prepared; that is, attached to little rolls of beeswax, so that if a point is unsuited for a particular work another can be substituted in a moment.

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Tolles' Thin Mechanical Stage.

THIS mechanical stage, as shown in the following figures, presents several points of novelty. The rectangular motions are controlled on the *surface* of the stage entirely within the circumference. The milled head on the right is attached by a pinion to the circular base-plate (milled on the edge), and carries a toothed wheel that moves both plates in the vertical by a side-rack shown in the slot opening; whilst the other one acts on a rack, under the bar in the hollow horizontal track that forms part of the upper plate, and causes this plate only to traverse. The two moving plates are of German silver, each about one-fiftieth of an inch in thickness; the lower one is held on the circular stage by three short pins with spring washers that travel in corresponding slots cut through the stage and forming a triangular support; the upper one lies nearly flat on the lower one, touching merely round the outer edge. The total thickness of this mechanical stage may

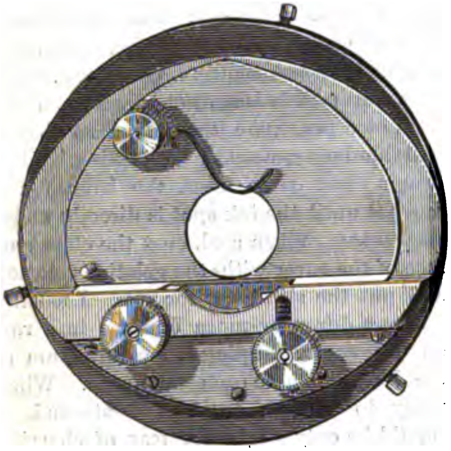

Fig. 1.

be better appreciated by a glance a
(*actual size*), in which the ring, gr
on the edge, is the main stage r
tached at right angles to the vertic
(shown in part) having within it
one that carries either of the two
stages figured, and which can be
centered to rotate on the optic axis
three steel screw studs (two of wh
seen on the edge). From the upper
of the moving plates, where the c
placed, the perpendicular thick
slightly less than half an inch—p
the thinnest mechanical stage ever
a first-class stand. As no portions
stage project beyond the circular
any position of motion, the comple
tion can be made. The absence of
ing pinions or milled heads is of s
vantage in connection with the ful
swing of the substage.

When the microscope is placed
tal, the object on the stage is in a
dicular axis, passing through the c
the rotating foot; if then a lamp f
adjusted in a line with the optic a
rotation of the microscope on the f
provide a practically perfect range
lique illumination on either side
hemispherical lens, as applied to thi
by Mr. Tolles for immersion illumi
adds greatly to the facility of obtai
fects of obliquity; indeed, he app

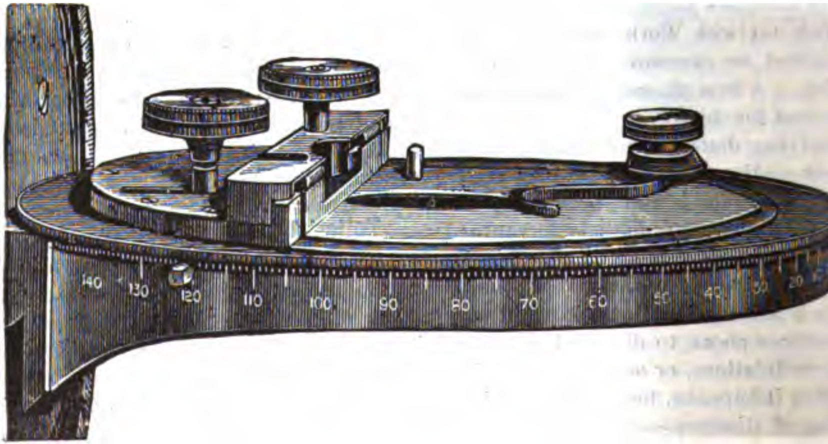

Fig. 2.—TOLLES' THIN MECHANICAL STAGE.

supporting ring necessary for centering-screws (to control the centering ring not shown in the figure). It is safe to say that *that* thickness can be the thickness of the thinnest centering hand-movement stage.

We have thus the minimum of thickness and the maximum of strength.

The plate, B, is graduated in degrees at its margin throughout, a gain both in extent of the graduation and in convenience.

Finally, there is the same facility of attachment and displacement of the "hemispherical," or central *traverse lens*, as obtains in the simplest non-mechanical stage. It attaches directly, in its cell, at the well-hole of the stage, which is the central part of B, the revolving plate.

The Microscope in Geology.*

AT the time of the organization of this Association, the subject of this paper, "The Geology of Bodie." might have been considered ill-suited to and out of place before a Microscopical Society. But at that time the microscope in Geology may be said to have been quite in its infancy, and even at the present time we are looking forward to great revelations by its more extended application.

The portion of that branch of Geology which the late Mr. Jukes defined as "Geognosy," which is of real importance for *industrial purposes*, is that which includes the mineral composition and structure of rocks, such as can be determined in the laboratory by the aid of hand specimens, and is termed "Lithology" (stone lore). The use of the microscope in the hands of some of our most eminent geologists, and the results obtained by them from it, have proved this instrument of research to be of the greatest value, or I may say, to be absolutely indispensable in that branch of geological investigations just mentioned.

For the past eight years I have devoted a large portion of my time to the study of the walls or enclosing rocks of metalliferous veins, and have made minute and careful investigations of them, but without the microscope, my labors would have been of a most unsatisfactory character, as rocks of sedimentary or stratified deposits have the same chemical composition as those of an intrusive nature, and can only be distinguished by the aid of the microscope. Eruptive rocks, for instance, whatever be their age, under microscopical examination exhibit certain definite charaters distinguishing them at once from all others. No one on this coast is better able to bear testimony to the correctness of this statement than our State Mineralogist, Mr. Hanks. I think I may venture to remark that no mining engineer's or expert's report on mines can be fairly relied upon unless he is able to distinguish the true character of the enclosing wall-rocks, and this he cannot do unless he understands the use of the microscope.

The exact methods of investigation demanded at the present day will only regard such terms as "favorable formation," etc., as expressions of comparative ignorance, and the reputation of those using them must suffer greatly. A knowledge of the proper place for sinking shafts, driving drifts or cross-cuts, is quite as necessary as to know how to use the pick, gad. drill and shovel, and I may say that the money that has been thrown away on the Comstock alone for want of such a knowledge, would have built up manufactories in California that would have made it the envy of the whole world. Now, with respect to gold—auriferous lodes or veins are not characteristic of any sedimentary stratum or formation, but are always met with in conjunction with the outburst of eruptive rocks, both plutonic and volcanic (I use the old classification of eruptive rocks, "plutonic," old; "volcanic," new; though I am well aware that evidence can be adduced to show that they graduate into one another, and consequently that it is more hypothetical than real), as representing, in my belief, a very marked and real distinction in the ages of the gold contained in the rocks; and I hope to show that the condition of the gold demonstrates clearly the character of the enclosing rock of the lodes or veins from which it was obtained. The gold of the first age, or that found in connection with plutonic rocks, being only slightly alloyed with silver, whilst that met with in the second age has, in some instances, been found to contain nearly fifty per cent. of silver. So that the condition of the gold in nearly every case I have examined has correctly indicated the character of the enclosing rocks of the lodes; and on the other hand, the study of the enclosing rocks has told me the condition of the gold I should be likely to meet with in them. Specimens of gold accompanying this paper, which came from Grass Valley and Bodie, are rolled out into thin strips, to show and illustrate the marked difference in the appearance of the two kinds.

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*Paper read by Melville Atwood, Esq., before the San Francisco Microscopical Society, June 13th, 1881, on the Geology of Bodie, illustrating the two ages of gold.

I have carefully studied this matter, and a collection of gold and wall rocks from nearly every part of the world, confirms the correctness of these conclusions, which I believe to be of universal application.

The gold in metalliferous *belts* like that of the Comstock, which follows the contour of the east side of Mount Davidson, or in the metalliferous channel of Bodie, which runs along the centre of the ridge from Bodie Bluff, each contains a uniform proportion of silver, alloyed with gold, from the outcrop of the veins at the surface to the deepest workings. So in the milling, say of the Bodie ore, the proportion of silver in 100 grains of the native alloy would be 37 grains, any above that obtained in milling would be from the mineralized silver mixed with the vein matter.

The native alloy of the Comstock belt in every 100 grains contains about 43 grains of silver. Many who have not made careful examination of the rocks in the proximity of those auriferous quartz veins, which are enclosed or occupy the planes of "cleavage" in slaty rocks, the mother lode for instance, which appears to be on the line, and caused by the outburst of eruptive rocks, might think that those veins had no connection with plutonic rocks, and that the greenstone (really diorite), generally met with on the hanging walls of that lode, was a sedimentary rock. Such mistakes are of frequent occurrence.

Specimen marked "A," also section cut from it, is from the hanging-wall of the Eureka mine, Grass Valley. The serpentineous character of a portion of this specimen is exceedingly interesting. I am of opinion that the serpentine to the north of the Eureka and Idaho lodes, was originally an intrusive igneous rock. Specimen "B" and section is from the Sierra Buttes mine; specimen "C" and section from the Oneida mine, Amador; and specimen "D" and section from the Pine Tree, Mariposa. These are all associated with the gold of the first age.

The metalliferous or ore channel of Bodie, extends the whole length and breadth of the ridge, i.e., from what is known as Bodie Bluff to Queen Bee Hill, having a length of 10,800 feet and a breadth of 3,600. (See general view of Bodie, Mr. Anderson's map of that place.) The prevailing rock is a trachytic diorite, in almost every stage of alteration; the same character of rock that forms the hanging-wall or eastern boundary of the Comstock Lode, and which appears at the Comstock to occur in two forms—sheets and dykes. On the top of the Bodie Bluff the rock is what was called in the old terminology, "Trachyte Amphibole Andesite." From the top of Bodie Bluff to the lowest workings of the Standard mine, altogether a depth of 1,264 feet, the rocks, though apparently of very different varieties, are all really merely local differentiations of the same rock, which can be seen and examined from the Bluff to the Osceola shallow level; from that down to the Syndicate Tunnel in the Tioga mine, in its workings below the Syndicate Tunnel, and in the Standard mine down to the 1,000-foot level, making a section of 1,264 feet.

If you will examine the longitudinal section which I have placed under the general view of Bodie, the numbers marked on it indicate the different parts from which the specimens which I now submit for your examination were taken. These rocks belong to the latter part of the Tertiary and the beginning of the post Tertiary periods.

Silver Hill is in places capped by a volcanic conglomerate; near the entrance of the Aurora tunnel and also south of the Queen Bee Hill are some basaltic rocks, sections cut from which very much resemble those from American Flat on the Comstock. What is called the "white cap" is a pyritous greyish-white trachytic, very similar to that which is mentioned by Mr. Dainbree in his paper on "The Occurrunce of Gold in Australia." Specimen No. 1 and section, Bodie Bluff; specimen No. 2 and section, Tioga mine; specimen B 2 and section, Belvidere mine; specimen No. 3 and section, Bulwer Tunnel; specimen No. 4 and section, Syndicate Tunnel; specimen No. 5 and section, end of east cross-cut, 500-level, Standard mine; specimen No. 6 and section, 430-level, Bodie mine; specimen No. 7 and section, 800-level, Tioga mine; specimen No. 8 and section, 500-level, Dudley mine; specimen No. 9 and section, 1,000-level, Standard mine; specimen No. 10 and section, White Cap, Silver Hill; specimen No. 11 and section, wall rock, Noonday Lode; specimen No. 12 and section, wall rock, Noonday Lode; specimen No. 13 and section, basaltic rock east of Aurora Tunnel; specimen No. 14 and section, Comstock, Gold Hill, at 1,700 feet.

There is a jointed structure running north and south through all the Bodie ore channel, in which the planes of jointure have a north and south direction and a slight dip either to the east or west, in conformity with the configuration of the hill. These planes of jointure are either filled with clayey matter or veins, the former, as well as the latter, though in a less degree, being metalliferous, and in reality this is what may be said to form the Bodie ore channel. There are two marked and distinct classes of veins met with in the Bodie ore channel: first, large veins called lodes or true veins; and the second, small veins, gash or crevice veins—the first occupying portions of fissures or rents, which divide and dislocate the jointed structure, causing a vertical displacement, generally on that side of the country rock which forms the hanging wall. The amount of displacement, or "throw," as it is called, can easily be seen and measured in sedimentary rocks, which have alternating beds of limestone, shales, sandstones, etc.; but in eruptive rocks, like those of Bodie, it is very difficult to make any calculation respecting it. The underlie of the Bodie true veins varies from 40 to 60 degrees, these veins being from a few to 30 feet in width. The non-metallic or gangue portion of the lode consists principally of quartz and carbonate of lime. The metallic portions are electrum and native silver, mixed mineralized metals in the form of cerargyrite and polybasite, etc., beside which a small quantity of magnetic iron and iron pyrites, and what the miners term "wad"—an earthy oxide of manganese—is found. A large portion of the gold or electrum is met with in a loose and free state, so much so that it might nearly be sluiced out just as it comes from the mine. The Noonday and Standard main lodes belong to this class, though the Noonday underlies to the east and the Standard to the west. At Silver Hill, which is very correctly named, lodes also of this character are met with, such as the Oro, etc., in which rich and most beautiful specimens of pyrargyrite are found; also some rare silver ore, curiously mixed with gold or electrum, has been taken from a mine called the Concordia, which I much regret not having had an opportunity of examining.

I think the prospects of rich silver mines at the south end of the Bodie ore channel are very good. The second-class small veins, gash or crevice veins, are very numerous at the north end of the Bodie Ridge. They merely fill portions of the planes in the jointed structure, their underlie being the same as the dip of the planes of jointure, which they sometimes follow down till intersected by other diagonal joints running along diagonals into other dip joints.

This class of veins is very limited in extent, and generally give out at no inconsiderable depth. Many of these veins terminate in the hanging-walls of the larger veins or lodes. With respect to the filling of these veins, vast periods of time must have elapsed for such processes to have taken place. Rocks met with at or near the surface of the ground, and also those at great depths, appear never to be in a state of rest; they are always changing, or undergoing some alteration—in a measure proving the *uniformitarian* doctrine, which maintains that all changes were produced by the slow and continuous action of causes now in operation.

In the depression of the ridge near the north end (see general view of Bodie), the rocks "in place" are covered to a depth varying from 50 to 100 feet by debris, consequently very few of the veins in that part of the ground have any surface but crop, and are what the Californian miners term "blind leads." At some future time I hope to be able to give you a detailed description of the rock sections. I now submit to you analyses of the different rocks.

It is perhaps unnecessary for me to add that there is no porphyry or felspathic porphyry on the Bodie Ridge. The term "porphyry" means, without addition or qualification, "quartz porphyry," a plutonic and much older rock than any met with in Bodie.

I never remember having seen any lode which was worth working that had porphyry for its walls.

I was in hope of getting analysis made of some of our California rocks at the laboratory of the Mining Bureau, but that useful and really necessary part of that institution was starved out almost at its birth by the withdrawal of the necessary funds to carry it on; so that in future any important rock must be sent to England for analysis. The mining community of this State know either too much or too little; they build gorgeous and costly marble palaces for instruction in stock speculations, but appear to be sensitively economical in supporting any institution that would afford practical instruction to the working miner. California, I believe, is the only civilized part of the world that can boast of not having a geological map. The need of such a map and of a collection of the minerals and rocks of the State does not appear to be rightly understood.

In 1851 I assisted in making a collection of the iron ores of Great Britain for the Industrial Exhibition of that year, the results of which and the value of a geological map are told in a few words by Prof. W. W. Smyth, in his introductory lecture on the opening of the London School of Mines, 1852:

"Few among the crowds who at the late Industrial Exhibition swept past the series of iron ores brought together from all parts of Britain by Mr. Blackwell could have prophesied that the collection of a half dozen of those sombre stones would give rise within a few months to an active industry which bids fair to develop a new phase in the gigantic phenomenon of the British iron trade. An example this of the mutual dependence and assistance of the three sister sciences, where geological reasoning had to point out the tract in which a given formation was to be found; mineralogical observation to discover the actual deposit, and chemical analysis to determine the value of the ore."

The Cleveland iron ore alluded to occurs in beds of from 15 to 20 feet thick in the Middle Leas. So that after the discovery of the ore at Cleveland, those interested in iron making, had only to consult the geological map to know where to look for it. One-quarter of the iron production of Great Britain is from that source. I trust I may not be misunderstood in this communication, which is really a very humble effort to attract attention to improvements in legitimate mining. Are there not numerous sources of mineral wealth lying unemployed because we do not understand how to take advantage of them? I feel sure that enlarged opportunities of learning brought within the reach of the working miner must produce their fruits in due season.

In conclusion, the result of many years of experience in its use, confirms me in the belief that the *Microscope in Mining*, with which the miner is enabled to distinguish the true character of the country rocks, will soon be found to be an instrument nearly equal in importance and as necessary in mining as the compass is in navigation.

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The Germ Theory.[*]

BY PROF. PASTEUR.

GENTLEMEN—I had no intention of addressing this admirable Congress, which brings together the most eminent medical men in the world, and the great success of which does so much credit to its principal organizer, Mr. MacCormac. The goodwill of your esteemed President has decided otherwise. How could one, in fact, resist the sympathetic words of that eminent man whose goodness of heart is associated in no small degree with great oratorical ability? Two motives have brought me to London. The first was to gain instruction, to profit by your learned discussions; and the second was to ascertain the place now occupied in medicine and surgery by the germ theory. Certainly I shall return to Paris well satisfied. During the past week I have learned much. I carry away with me the conviction that the English people are a great people, and as for the influence of the new doctrine, I have been not only struck by the progress it has made, but by its triumph. I should be guilty of ingratitude and of false modesty if I did not accept the welcome I have received among you and in English society as a mark of homage paid to my labors during the past five-and-twenty years upon the nature of ferments—their life and their nutrition, their preparation in a pure state by the introduction of organisms (*ensemencement*) under natural and artificial conditions—labors which have established the principles and the methods of microbie (microbism), if the expression is allowable. Your cordial welcome has revived within me the lively feeling of satisfaction I experienced when your great surgeon, Lister, declared that my publication in 1857 on milk fermentation had inspired him with his first ideas on his valuable surgical method. You have reawakened the pleasure I felt when our eminent physician, Dr. Davaine, declared that his labors upon charbon (splenic fever or malignant pustule) had been suggested by my studies on butyric fermentation and the vibrion which is characteristic of it. Gentlemen, I am happy to be able to thank you by bringing to your notice a new advance in the study of microbie as applied to the prevention of transmissible diseases—diseases which for the most part are fraught with terrible consequences, both for man and domestic animals. The subject of my communication is vaccination in relation to chicken cholera and splenic fever, and a statement of the method by which we have arrived at these results—a method the fruitfulness of which inspires me with boundless anticipations. Before discussing the question of splenic fever vaccine, which is the most important, permit me to recall the results of my investigations of chicken cholera. It is through this inquiry that new and highly important principles have been introduced into science concerning the virus or contagious quality of transmissible diseases. More than once in what I am about to say I shall employ the expression virus-culture, as formerly, in my investigations on fermentation, I used the expressions, the culture of milk ferment, the culture of the butyric vibrion, etc. Let us take, then, a fowl which is about to die of chicken cholera, and let us dip the end of a delicate glass rod in the blood of the fowl with the usual precautions, upon which I need not here dwell. Let us then touch with this charged point some *bouillon de poule*, very clear, but first of all rendered sterile under a temperature of about 115° Centigrade, and under conditions in which neither the outer air nor the vases employed can introduce exterior germs—those germs which are in the air, or on the surface of all objects. In a short time, if the little culture vase is placed in a temperature of 25° to 35°, you will see the liquid become turbid, and full of tiny microbes, shaped like the figure 8, but often so small that under a high magnifying power they appear like points. Take from this vase a drop as small as you please, no more than can be carried on the point of a glass rod as sharp as a needle, and touch with this point a fresh quantity of sterilized *bouillon de poule* placed in a second vase, and the same phenomenon is produced. You deal in the same way with a third culture vase, with a fourth, and so on to a hundred, or even a thousand, and invariably within a few hours the culture liquid becomes turbid and filled with the same minute organisms. At the end of two or three days' exposure to a temperature of about 30 C. the thickness of the liquid disappears, and a sediment is formed at the bottom of the vase. This signifies that the development of the minute organism has ceased—in other words, all the little points which caused the turbid appearance of the liquid have fallen to the bottom of the vase, and things will remain in this condition for a longer or shorter time, for months even, without either the liquid or the deposit undergoing any visible modification, inasmuch as we have taken care to exclude the germs of the atmosphere. A little stopper of cotton sifts the air which enters or issues from the vase through changes of temperature. Let us take one of our series of culture preparations—the hundredth or the thousandth, for instance—and compare it in respect to its virulence with the blood of a fowl which has died of cholera; in other words, let us inoculate under the skin ten fowls, for instance, each separately with a tiny drop of infectious blood, and ten others with a similar quantity of the liquid in which the deposit has first been shaken up. Strange to say, the latter ten fowls will die as quickly and with the same symptoms as the former ten; the blood of all will be found to contain after death the same minute infectious organisms. This equality, so to speak, in the virulence both of the culture preparation and of the blood is due to an apparently futile circumstance. I have made a hundred culture preparations—at least, I have understood that this was done—without leaving any considerable interval between the impregnations. Well, here we have the cause of the equality in the virulence. Let us now repeat exactly our successive cultures with this single difference, that we pass from one culture to that which follows it—from the hundredth to, say, the hundred and first, at intervals of a fortnight, a month, two months, three months, or ten months. If, now, we compare the virulence of the successive cultures, a great change will be observed. It will be readily seen from an inoculation of a series of ten fowls that the virulence of one culture differs from that of the blood and from that of a preceding culture when a sufficiently long interval elapses between the impregnation of one culture with the microbe of the preceding. More than that, we may recognize by this mode of observation that it is possible to prepare cultures of varying degrees of virulence. One preparation will kill eight fowls out of ten, another five out of ten, another one out of ten, another none at all, although the microbe may still be cultivated. In fact, what is no less strange, if you take each of these cultures of attenuated virulence as a point of departure in the preparation of successive cultures, and without appreciable interval in the impregnation, the whole series of these cultures will reproduce the attenuated virulence of that which has served as the starting point. Similarly, where the virulence is null it produces no effect. How, then, it may be asked, are the effects of these attenuating virulences revealed in the fowls? They are revealed by a local disorder, by a morbid modification more or less profound in a muscle, if it is a muscle which has been inoculated with the virus. The muscle is filled with microbes which are easily recognized because the attenuated microbes have almost the bulk, the form, and the appearance of the most virulent microbes. But why is not the local disorder followed by death? For the moment let us answer by a statement of facts. They are these: the local disorder ceases of itself more or less speedily, the microbe is absorbed and digested, if one may say so, and little by little the muscle regains its normal condition. Then the disease has disappeared. When we inoculate with the microbe the viru-

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[*] An address delivered at the meeting of the International Medical Congress held in London August 5th-9th, 1881.

lence of which is null there is not even local disorder, the *naturæ medicatrix* carries it off at once, and here, indeed, we see the influence of the resistance of life, since this microbe, the virulence of which is null, multiplies itself. A little further, and we touch the principle of vaccination. When the fowls have been rendered sufficiently ill by the attenuated virus which the vital resistence has arrested in its development, they will, when inoculated with virulent virus, suffer no evil effects, or only effects of a passing character. In fact, they no longer die from the mortal virus, and for a time sufficiently long, which in some cases may exceed a year, chicken cholera cannot touch them, especially under the ordinary conditions of contagion which exist in fowl-houses. At this critical point of our manipulation—that is to say, in this interval of time which we have placed between two cultures, and which causes the attenuation—what occurs? I shall show you that in this interval the agent which intervenes is the oxygen of the air. Nothing more easily admits of proof. Let us produce a culture in a tube containing very little air, and close this tube with an enameller's lamp. The microbe in developing itself will speedily take all the oxygen of the tube and of the liquid, after which it will be quite free from contact with oxygen. In this case it does not appear that the microbe becomes appreciably attenuated, even after a great lapse of time. The oxygen of the air, then, would seem to be a possible modifying agent of the virulence of the microbe of chicken cholera—that is to say, it may modify more or less the facility of its development in the body of animals. May we not be here in presence of a general law applicable to all kinds of virus? What benefits may not be the result? We may hope to discover in this way the vaccine of all virulent diseases; and what is more natural than to begin our investigation of the vaccine of what we in French call charbon, what you in England call splenic fever, and what in Russia is known as the Siberian pest, and in Germany as the Milzbrand. In this new investigation I have had the assistance of two devoted young *savants*—MM. Chamberland and Roux. At the outset we were met by a difficulty. Among the inferior organisms, all do not resolve themselves into those corpuscle germs which I was the first to point out as one of the forms of their possible development. Many infectious microbes do not resolve themselves in their cultures into corpuscle germs. Such is equally the case with beer yeast, which we do not see develop itself usually in breweries, for instance, except by a sort of scissiparity. One cell makes two or more, which form themselves in wreaths; the cells become detached, and the process recommences. In these cells real germs are not usually seen. The microbe of chicken cholera and many others behave in this way, so much so that the cultures of this microbe, although they may last for months without losing their power of fresh cultivation, perish finally like beer yeast which has exhausted all its aliments. The anthracoid microbe in artificial cultures behaves very differently. In the blood of animals, as in cultures, it is found in translucid filaments more or less segmented. This blood or these cultures freely exposed to air, instead of continuing according to the first mode of generation, show at the end of forty-eight hours corpuscle germs distributed in series more or less regular along the filaments. All around these corpuscles matter is absorbed, as I have represented it formerly in one of the plates of my work on the diseases of silkworms. Little by little all connection between them disappears, and presently they are reduced to nothing more than germ dust. If you make these corpuscles germinate, the new culture reproduces the virulence peculiar to the thready form which has produced these corpuscles, and this result is seen even after a long exposure of these germs to contact with air. Recently we discovered them in pits in which animals dead of splenic fever had been buried for twelve years, and their culture was as virulent as that from the blood of an animal recently dead. Here I regret extremely to be obliged to shorten my remarks. I should have had much pleasure in demonstrating that the anthracoid germs in the earth of pits in which animals have been buried are brought to the surface by earthworms, and that in this fact we may find the whole etiology of disease, inasmuch as the animals swallow these germs with their food. A great difficulty presents itself when we attempt to apply our method of attenuation by the oxygen of the air to the anthracoid microbes. The virulence establishing itself very quickly, often after four-and-twenty hours in an anthracoid germ which escapes the action of the air, it was impossible to think of discovering the vaccine of splenic fever in the conditions which had yielded that of chicken cholera. But was there, after all, reason to be discouraged? Certainly not; in fact, if you observe closely, you will find that there is no real difference between the mode of the generation of the anthracoid germ by scission and that of chicken cholera. We had therefore reason to hope that we might overcome the difficulty which stopped us by endeavoring to prevent the anthracoid microbe from producing corpuscle germs and to keep it in this condition in contact with oxygen for days, and weeks, and months. The experiment fortunately succeeded. In the ineffective (*neutre*) *bouillon de poule* the anthracoid microbe is no longer cultivable at 45° C. Its culture, however, is easy at 42° or 43°, but in these conditions the microbe yields no spores. Consequently it is possible to maintain in contact with the pure air at 42° or 43° a *mycelienne* culture of bacteria entirely free of germs. Then appear the very remarkable results which follow. In a month or six weeks the culture dies—that is to say, if one impregnates with it fresh *bouillon*, the latter is completely sterile. Up till that time life exists in the vase exposed to air and heat. If we examine the virulence of the culture at the end of two days, four days, six days, eight days, etc., it will be found that long before the death of the culture the microbe has lost all virulence, although still cultivable. Before this period it is found that the culture presents a series of attenuated virulences. Everything is similar to what happens in respect to the microbe in chicken cholera. Besides, each of these conditions of attenuated virulence may be reproduced by culture; in fact, since the charbon does not operate a second time (*ne recidive pas*), each of our attenuated anthracoid microbes constitutes for the superior microbe a vaccine—that is to say, a virus capable of producing a milder disease. Here, then, we have a method of preparing the vaccine of splenic fever. You will see presently the practical importance of this result, but what interests us more particularly is to observe that we have here a proof that we are in possession of a general method of preparing virus vaccine based upon the action of the oxygen and the air—that is to say, of a cosmic force existing everywhere on the surface of the globe. I regret to be unable from want of time to show you that all these attenuated forms of virus may very easily, by a physiological artifice, be made to recover their original maximum virulence. The method I have just explained of obtaining the vaccine of splenic fever was no sooner made known than it was very extensively employed to prevent the splenic affection. In France we lose every year by splenic fever animals of the value of 20,000,000f. I was asked to give a public demonstration of the results already mentioned. This experiment I may relate in a few words. Fifty sheep were placed at my disposition, of which twenty-five were vaccinated. A fortnight afterwards the fifty sheep were inoculated with the most virulent anthracoid microbe. The twenty-five vaccinated sheep resisted the infection; the twenty-five unvaccinated died of splenic fever within fifty hours. Since that time my energies have been taxed to meet the demands of farmers for supplies of this vaccine. In the space of fifteen days we have vaccinated in the departments surrounding Paris more than 20,000 sheep and a large number of cattle and horses. If I were not pressed for time I should bring to your notice two other kinds of virus attenuated by similar means. These experiments will be communicated by-and-by to the public. I cannot conclude, gentlemen, without expressing the great pleasure I feel at the thought that it is as a member of an international medical congress assembled in England that I make known the most recent results of vaccination upon a disease more terrible, perhaps, for domestic animals than small-pox is for man. I have given to vaccination an extension which science, I hope, will accept as a homage paid to the merit and to the immense services rendered by one of the greatest men of England, Jenner. What a pleasure for me to do honor to this immortal name in this noble and hospitable city of London!

Trichinæ Cysts.

THE mode of formation of the cyst of trichina has been studied by M. Chatin and described in a communication to the Académie des Sciences. It was formerly said to be formed partly from the contractile tissue, and partly by a secretion from the nematoid, but this opinion was based only on some apparent differences in the thickness or aspect of the cyst wall, and not on any careful study of its formation, which necessitates the examination of animals dying or killed in different stages of the affection. When it arrives in the muscles the worm forms adhesions with the interfascicular tissue in which rapid changes occur. The elements increase in size, and during the growth of the protoplasm it assumes the appearance of an amorphous mass, in which, however, nuclei and vacuoles can be seen, which seem to indicate that the mass consists really of aggregated cells. By the growth of this the primitive fibres are compressed. In the new protoplasm fine proteoid granulations are first observed, and then other granulations which present all the reactions of glycogen. Then follow important changes in the periphery of the granular mass, containing the trichina, now curled up in the interior; the outer surface becomes distinctly thickened and indurated, and may then become lamellated or present granulations or folds. The sarcolemma takes no part in the formation of the cyst except occasionally furnishing if with a purely adventitious layer. Moreover, when the nematoid contracts its first adhesions to the sarcolemma, and not to the interfascicular tissue, it rapidly dies without determining a new formation.—*London Lancet.*

Pennock's Oblique Diaphragm.

THE accompanying engravings show a new form of oblique diaphragm devised by Mr. E. Pennock, and designed to be attached to the under side of the stage for shutting off all light except a small pencil from the mirror. Its function is the same as Smith's >-shaped diaphragm. It is an adaptation of Mr. Mayalls spiral diaphragm, which was originally designed for use with condensers of wide aperture, and was described in a recent number of the *Journal of the Royal Microscopical Society.*

It may be mounted in either of two forms: the one to fit into the usual tube, which, in the cheaper microscopes, is attached to the under side of the stage; the other to screw directly into the stage aperture.

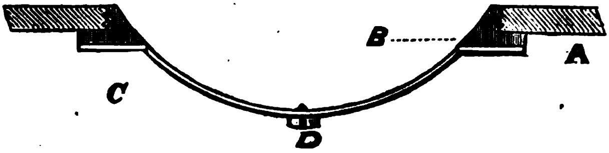

Fig. 3.

A. Stage of Microscope.
B. Ring carrying upper plate, which has radial slot cut in it.
C. Lower plate attached by screw, D, having spiral clot. Both this and ring, B, are milled on the edge. Or the plates may be flat as in Fig. 1.

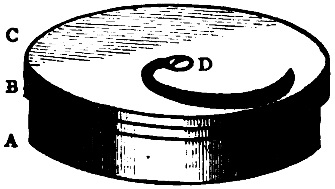

Fig. 1.

A. Tube, 1¼ inch in diameter, fitting into accessory-tube beneath stage.
B. Upper plate (shown as under) having radial slot.
C. Under plate, having spinal slot.
D. Screw joining the plates.

The manner of using it to obtain pencils of varying degrees of obliquity will be sufficiently manifest from the construction.

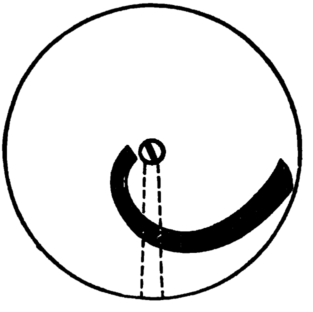

Fig. 2.—PLAN OF UPPER AND LOWER PLATES MOVING FULLY ON EACH OTHER.

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We can no longer supply Volume I either bound or in sheets. We have on hand a few copies of Vols. II, III, and IV, with full margins and handsomely bound in cloth, with gilt title, price $1.50 each.

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The American Society of Microscopists.

THE fourth annual meeting of the Society was held at Columbus, Ohio, August 9th, 10th and 11th, 1881, and the following officers were elected for the ensuing year: President, Dr. George E. Blackham, Dunkirk, N. Y.; Vice-Presidents, Dr. Lester Curtis, Chicago, Ill., and Dr. Thad. S. Up De Graff, Elmira, N. Y.; Secretary, for three years, Prof. D. S. Kellicott, 119 Fourteenth Street, Buffalo, N. Y.; Treasurer, for three years, Geo. E. Fell. C. E., 162 Prospect Avenue, Buffalo, N. Y.; Executive Committee, E. H. Griffith, A. M., Fairport, N. Y., Dr. Robert Dayton, Cleveland, Ohio, and Prof. Albert McCalla, Fairfield, Iowa.

The meeting was a decided success, notwithstanding the absence of President Hyatt. The President elect, Dr. Blackham, has just issued the following circular, which has the right ring, and so clearly points the way to success, that we give it in full:

"Among the officers thus elected there is, I am glad to say, an entire unanimity of sentiment and a determination to make the next meeting a complete success, both socially and scientifically, and no efforts on their part will be wanting to secure this very desirable end. The next meeting has been appointed at Elmira, N. Y., in August next, in compliance with the very generally expressed wish of the members present at Columbus.

We expect much assistance from the very liberal spirit which evidently animates the local society at Elmira in their preparations, already begun, for the comfort, convenience and entertainment of members who shall attend the next meeting.

In order to secure success, however, no efforts on the part of the officers of the society, or of the local committee, can be of any avail without hearty co-operation of the members of the society at large, and it is partly to secure this co-operation that this circular is issued. Permit me to suggest that the ways in which members can aid in securing success are, chiefly:

First.—Personal attendance at the annual meetings.

Second.—The preparation and presentation of papers to be read at the annual meetings.

Third.—Preparation and presentation of brief notes of practical interest.

Fourth.—Increase of membership by recommending suitable persons for this purpose to the Executive Committee.

For subjects of papers permit me to suggest:

First.—Original investigations in any department of Microscopical Science.

Second.—Microscopical investigations of the water supply of various localities.

Third.—Reports giving lists of the microscopic fauna and flora of various localities.

Fourth.—Clinical reports from physicians and surgeons of interesting cases in which the microscope has been of use in diagnosis, with drawings of the morbid histology in the case.

Fifth.—Description of new instruments or apparatus.

Sixth.—Papers for the Griffith prize; in in reference to which a special circular giving conditions, etc., will be forwarded to all members.

As the funds of the society are now ample for the proper publication of all papers accepted for publication by the committee, it is hoped that members will avail themselves more largely than ever of this opportunity of putting the results of their labors in permanent form.

Members who presented papers at the Columbus meeting are respectfully reminded that the papers and drawings fully revised, should be in the hands of the secretary by October 15th, 1881, to ensure publication in the proceedings.

Members are requested to send to the secretary their exact post-office address, giving their street and number, and the title by which they should be addressed.

Finally, members are earnestly requested to communicate with the President, Secretary or Treasurer whenever they have anything to offer for the good of the society, or desire any information concerning it.

Respectfully,

George E. Blackham.
President, A. S. M."

Correspondence.

The Editor of the American Journal of Microscopy does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Fine Rulings.

Ed. Am. Jour. Microscopy—There seems to be some misapprehension in regard to my claims for fine ruling up to 10,000,000 lines per inch. The truth is, I have never claimed to rule that figure. I believe I once communicated the fact that my ruling engine had an index capacity of 10,000,000, but it was necessary to arrange it thus in order to facilitate the subdivision in the lower figures.

I have ruled plates up to 1,000,000 lines to the inch, one of which was purchased by the U. S. Government at Washington.

These plates show lines truly and fairly ruled, as far as lenses are able to resolve, and above this point the *spectral* appearance of the bands in regular succeeding colors (when examined as an opaque object) shows, beyond doubt, that each band contains fairly ruled lines up to the 1,000,000 band.

Dr. Ward seems to think that the simple setting of the register of a ruling engine to the 1-10th or 1-10,000,000th of an inch, is all that is required to produce a ruling. I know that very many other conditions must be satisfied to produce perfect rulings.

I do not believe that I will ever attempt to rule higher than 1,000,000 lines per inch, as from my practical experience and judgment I have concluded that that is the limit of ruling.

C. Fasoldt.

Current Notes.

Spores.—In microscopical examination, spores may be confounded with fat globules, blood discs, nuclei of epithelium cells, pus, globules, etc. The diagnosis can be absolutely determined only by the use of reagents. Spores are unaffected by ether, chloroform and alcohol. These dissolve fat cells and render epithelium transparent. Ammonia makes spores a little more colorless. It dissolves pus, and secretions of eruptive diseases, making a gelatinous mass. Hot solution of potash with alcohol dissolves impetiginous crusts, fat, pus, hair and epithelium. Acids destroy earthy particles.—*Medical and Surgical Reporter.*

Jelly-fish.—Mr. Romanes, F.R.S., in his lecture at Trinity College, recently, on jelly-fish, mentioned two or three facts respecting this interesting animal, which, though well known to biologists, may be new to many. The lecturer stated that he had found by experiment that the fresh-water species were as intolerant of salt water as the marine species were of fresh. Jelly-fish were very various in form, but, although divergent in shape, they all presented fundamentally the same anatomical structure. However minutely cut up, each portion would develop into a perfect animal. The lecturer also showed that alcohol possessed an intoxicating power over jelly-fish.

Living Animals and Plants for the Microscope.—European microscopists enjoy special facilities for procuring plants and animals which are not common to their localities. Several microscopists, notably Mr. Bolton, of Birmingham, England, make a specialty of sending living specimens by mail to their subscribers. We are glad to learn that Mr. A. D. Balen, of Plainfield, N. J., has undertaken to furnish specimens to his correspondents. He has devised certain novel methods of transmitting them, and as he is located in a region which is peculiarly rich in rare and beautiful forms, we see no reason why his enterprise should not prove a success.

More Microscopical Journals.—J. J. M. Angear, A.M., M.D., Prof. of Physiology and Pathology in the College of Physicians and Surgeons at Keokuk, and President of the Microscopical Section of Iowa State Medical Society, has accepted the editorship of the Microscopical and Pathological Department of the *Western Medical Reporter*.

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TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

San Francisco Microscopical Society.—The semi-monthly meeting of the San Francisco Microscopical Society was held at the rooms on Sutter street, June 13th, 1881. Dr. J. H. McLean and Arthur E. Hickox were elected life members, and H. Bernard, Esq., a regular member of the Society. This being the first meeting under the new constitution of the Society, was held on Monday evening instead of Thursday evening, as under the old charter. Hereafter the meetings will be held on the second and fourth Monday evenings of each month. Mellville Attwood, Esq., read a paper entitled "Rough Notes on the Geology of Bodie, illustrating the two ages of gold," which will be found in full in another column. It was listened to with great interest, and his specimen samples of cut rocks and rolled gold examined with much pleasure. After Mr. Attwood's paper, the Society had the pleasure of an impromptu lecture by ex-President William Ashburner on "Angular Aperture," illustrated by diagrams. This was very much enjoyed, and the meeting was a highly instructive one for all present.

Camden Microscopical Society.—This Society, which was organized November 7th, 1878, with a membership of eighteen, now numbers fifty-four, thirty-six of whom are active, and eighteen contributing members.

Since its organization it has accomplished a considerable amount of valuable scientific work. Although organized for the study, investigation and advancement of microscopic science, yet much has also been done in other directions. It possesses a very complete herbarium of the *flora* of New Jersey; a valuable mineralogical cabinet, and is now engaged in making a complete collection of the birds of the State, which is already quite large, and accessions to it are being constantly made. The meetings of the Society, on the first and third Thursday evenings of every month, are usually quite interesting, and all persons interested in scientific work are cordially welcome.

The present officers of the Society are: President, Dr. A. P. Brown; Secretary, C. Henry Kain; Treasurer, L. T. Derouse; Managers, H. S. Fortiner, Robert Patterson, and S. H. Quint, M.D.; Curator, Prof. E. F. Moody.

Upon several occasions the Society has given public receptions, all of which have been largely attended by the ladies and gentlemen of our city. The last of these occurred on Thursday evening, June 16th, and was quite largely attended. The instruments were placed on both sides of a line of tables arranged in the centre of the hall so that spectators could move freely around them. At the head of the table President Brown exhibited the eggs of a snail, in which the movements of the embryo were very distinct. Under the polariscope the play of colors made this a most beautiful object. To the naked eye these eggs appear transparent jelly-like masses. They are found attached to the stems of water-plants, and each mass contains a number of eggs. Next came Dr. Middleton, with a genuine "oh my" slide, platino-cyanide of magnesium by polarized light. One who has never before seen chemical crystals displayed under the polariscope is amazed at the beautiful play of colors as the analyzing prism is rotated. At the next table Mr. Wm. J. Morrison had a very lively slide of *Anguillula Aceti*, or vinegar eels. A sight of the wriggling mass is apt to call forth the inquiry, "Does all vinegar contain them?" Good, pure, cider vinegar usually does, but science has discovered that the addition of a very small portion of sulphuric acid to cider vinegar entirely prevents their attendance. The addition is perfectly harmless. Mr. Morrison also exhibited a slide of *Ptilota Elegans*, a beautiful marine alga found on the northern coast of our State. Mr. Joseph Stokes exhibited the mandibles of a spider. These consist of two joints, the one next the head being thick and very strong, the other is curved and sharply pointed. It is traversed by a canal terminating at its apex, through which the secretion of a poison-gland passes into any body transfixed by the claw. Mr. George T. Robinson exhibited the dreaded pork-worm, *Trichina Spiralis*, encysted in human muscle. This slide also showed, in a beautiful manner, the striated nature of the voluntary muscles. Mr. Harry S. Fortiner exhibited a variety of chemical crystals under the polariscope, notably. *Phloridzin*, a substance extracted from the bark of the apple, pear, plum, or cherry tree. Mr. Fortiner has given much attention to the preparation of chemical crystals for the polariscope, and his work in this line excels. Mr. William D. Clark exhibited the fructification of a fern—*Pteris Geranifolia*. An exhibit by Mr. Frank Harned attracted a great deal of attention on account of its novelty—the electric spark from a Rhumkorff coil, between carbon points. By means of a Holman's siphon slide, Mr. Charles Bowden showed the circulation of the blood in a young eel. These living objects always attract much attention, and this was one of the most instructive as well as interesting slides exhibited during the evening. The popular idea is that *gizzards* are organs pertaining only to birds, but several years ago Dr. C. C. Abbott, of Trenton, discovered that New Jersey possesses a *shad* with a gizzard, and Dr. L. H. Street exhibited the *gizzard of a grasshopper*. It is said that crickets and cockroaches also furnish gizzards, which are favorite objects with the microscopists. The object was prepared by Mr. S. T. Cowles, of Otisco, N. Y., an enthusiast in the matter of insect anatomy. A slide prepared by the same gentleman, exhibiting the tracheal system, or breathing apparatus of a beetle larva, also attracted a great deal of attention. Mr. L. T. Derousse exhibited a specimen of *Mucoroidea* or mould upon dough. Distasteful as these moulds are to the careful housewife, they are beautiful objects under the microscope. Mr. R. Bingham exhibited a slide prepared by Mr. J. L. De La Cour, showing filaments of silk of *Bombyx Mori* and of *Cynthia* in the same field of view for the purpose of comparison. Those of the first-named were flat, greatly resembling vegetable fibre in this respect, the latter were cylindrical. Mr. C. Henry Kain exhibited *Infusoria* in stagnant water. "Oh, my!" said a lady on viewing this miniature menagerie—"do we have to drink such things as that?" It is gratifying to a fastidious taste to know that good potable water contains few or no infusoria. They are only present where decaying organic matter exists. Mr. Kain also exhibited crystalized gold and miscellaneous objects.

An exhibit that attracted much attention, although not microscopical in its character, was a series of cards on which were arranged marine algæ and zoophytes from the coast of California. The specimens of *Plumularia* and *Corallina Officinalis* were remarkably fine. They were handsomely displayed under the graphoscope, and were arranged by Mrs. Harned, of Camden.

We understand that it is the purpose of the Society to hold these receptions more frequently in the future. Free tickets of admission may be had by applying to any of the officers or members.

On the evening of July 7th, Mr. Nathan T. Perkins, of Merchantville, delivered a lecture on "Forest Trees" before the Society.

Reading Society of Natural Sciences.—At the meeting of this Society, held June 23, the principal feature was the microscopical exhibition. There were twenty-seven microscopes on exhibition. Among those present were many prominent citizens and scientists, and the interest manifested was most pronounced. The Reading gentlemen interested in this particular branch of science, and who were present with instruments, were Dr. M. A. Rhoads, Dr. Stanly Smith, each having two instruments on exhibition; Dr. William F. Muhlenberg, Dr. P. M. Ziegler, Dr. J. Ellis Kurtz, Prof. D. B. Brunner, and Dr. Israel Cleaver, each having one instrument. A number of new and beautiful specimens were exhibited, the gentlemen in attendance explaining the nature and points of each as they were shown.

Fairfield (Iowa) Microscopic Club.—Thursday evening, July 28th, the Fairfield Microscopic Club held its first annual reception in the Presbyterian church. Printed invitations were issued in due form, and a large and appreciative company, composed of the *elite* of the city, was in attendance. The exercises of the evening were opened with prayer by Rev. A. S. Wells, and occasionally interspersed with music by Misses Thompson, Mohr and Stribling. The first address on the programme, "Microscopic Vision," was delivered by Dr. R. J. Mohr. He showed in this the wonderful magnifying properties of the microscope, and gave numerous instances of the exquisitely fine tests to which objects had been subjected by this powerful little instrument. The next address, "Practical Uses of the Microscope," was delivered by Prof. A. McCalla, in which the gentleman proved the microscope to be a first class detective and investigator. He cited a number of interesting instances of its uses in each case, proving it to be of inestimable value in the cause of scientific research. The professor illustrated his remarks in a practical manner, showing a number of fine objects by the aid of the stereopticon and projection microscope. Then followed an exhibition of microscopic objects. Specimens within the scope of botany and mineralogy were shown by Prof. A. McCalla and Geo. D. Clarke. Circulation of blood was shown by Dr. T. L. James. This was finely illustrated in the case of circulation in a frog's foot. Specimens belonging to the province of entomology were exhibited by John Grinstead. Histology and pathology were illustrated by Dr. R. J. Mohr, assisted by C. E. Stoner, the former gentleman possessing one of the very finest and latest microscopes that can be procured. A section of diseased liver, cancer and numerous other objects were shown under this instrument. Miscellaneous objects was the class assigned to Dr. D. H. Worthington.

The club feels highly flattered and encouraged by the appreciation manifested by the citizens in its first public effort, and hope to be able to furnish other and better entertainments in the future. SECRETARY.

Buffalo Microscopical Club.—A largely attended meeting of the Microscopic Club was held Wednesday evening, September 14th, at the rooms kindly placed at their disposal by the Common Council. The Secretary, Dr. Lee H. Smith, reported that the club was in a very flourishing condition, financially and otherwise. He called attention to the many new names that had been added to the roll and the increasing interest in the proceedings. The broad and liberal basis upon which it was organized had been sufficient to secure support both public and private. The papers presented at the meetings up to last June are of the greatest interest, not only securing ready publication but republication in the leading technical journals. The Club had opened for 1881–82 with a full attendance, and the manifest determination of each member to make the coming winter more successful than any in the past.

Mr. Fell presented a short review of the Columbus Meeting of the American Society of Microscopists. The future success of the Society, he said, was assured by its large attendance and the many original papers which were read, showing the great advance that has been made in the past year. The preparations for the next meeting to be held at Elmira were already under way. Subscription papers were being circulated and had met with a reception so generous as to surprise the organization. He believed the gathering would surpass in every way any meeting that had been held heretofore in any country. The names of some of the most prominent microscopists were down for papers which would be original to a great extent and of incalculable value.

Professor Kellicott gave a review of the current microscopic literature, and emphasized the statement of Dr. Leidy that trichina were found in one of every ten thousand hogs. Professor Kellicot said he had never found trichina in the pork sold in the Buffalo markets. Trichina, in Prof. Leidy's opinion, are killed by the usual cooking process, and all food animals were liable to parasites. The suspicious character of the dust of our streets was referred to by Prof. Kellicott, it being dried and pulverized filth and dirt of a kind liable to produce disease of a virulent nature under certain conditions.

A paper by the President of the New York Microscopical Club on "Oleomargarine and Butter" was given in brief as follows:

The process was patented in 1873. There were exported in the year ending June, 1880, 19,838,330 pounds.

The Manufacture is thus:—

1. The caul fat is thoroughly washed and reduced to a pulpy condition.
2. The fat is separated from the adipose by melting at a temperature not higher than 125 degrees Fahrenheit. The oil after skimming is drawn off.
3. It is then packed in cloths and subjected to a gradually increasing pressure at a temperature or 80 to 90 degrees, until the oil is pressed out, leaving the stearine in the press.
4. The oil is churned with sour milk, drawn out of the churns into tubs containing pounded ice, when it immediately solidifies.
5. After separation from the ice it is crumbled by hand and again churned with sour milk, after which it is worked solid and packed.

The microscope will, when properly used, enable us to distinguish between "oleomargarine" and butter. The former, when perfect, contains no crystals.

Dr. W. C. Barrett made some very interesting remarks regarding his prosecution of the study of microscopy abroad.

Mr. Henry Mills called attention to the numerous varieties of animal life to be found on this side of the Niagara River, and the comparative dearth of material in the ponds and dams on the other side and in the country surrounding Buffalo.

Prof. Kellicott, in his report of personal work, gave an interesting history and description of several rare and peculiar larvæ of certain beetles—particularly the *Psephenus Lecontei*.

He also called attention to the finding by Mr. Mills and himself of the first of a new species of sponge, which was reported to the club in April. The spiculæ on this sponge had been examined by Mr. H. J. Carter, of Dublin, the most prominent authority of the present day on sponges, and erroneously pronounced to be parasitic. For this reason he stated that it should be considered as belonging to a species which he had discovered. The spiculæ being uniform, hollow, and closely attached to the body, it could not, except through some mistake in mounting or observation, be called parasitic any more than are the horns of a cow. The sponge was evidently new, and since two more specimens had been added by Mr. Potts, of Philadelphia.

The club adjourned at a late hour to meet October 11th. Prof. Kellicott will present a paper on some original investigations made this summer.

Canandaigua Microscopical Society.—A regular meeting of the Society was held at the residence of Dr. H. Jewett, on the evening of Tuesday, July 12th, 1881. The meeting was called to order at 8.30 P.M., and the minutes of the last meeting were read and approved. The following members were present: The President, Major C. A. Richardson, Dr. and Mrs. H. F. Bennett, Mr. and Mrs. S. D. Backus, Dr. Carson, Dr. Hallenbeck, Rev. Dr. Curtis, Rev. Mr. Hiscox, Miss Munger, Mr. John M. Clarke, Dr. J. Jewett, and honorary member, Prof. Geo. L. Smith.

In place of the regular appointee, Dr. Bennett, Prof. Smith, of Baltimore, kindly consented to give a paper upon "Food Adulteration." As was anticipated this subject was ably treated, and was of great interest to all present. The writer remarked that in the first place in the examination of foods, both chemically and microscopically to detect adulteration, he had followed in the main the methods of Hassall, but as the directions given by that author were only general, he had been obliged to learn many practical details by actual experience. Among the articles he had examined and found adulterated are tea, coffee, flour, sugar, milk, lard, mustard, oatmeal, potted meats, etc. The prevalence of adulteration in nearly all articles in the grocery line was forcibly illustrated in different ways. Even the farmers themselves, and especially those living near the cities, take part in this nefarious business, thus thwarting the fulfillment of the demand for pure country produce.

Tea was taken as an example of adulterated articles, and dwelt upon at some length. The tea plant is an evergreen plant, from 3 to 6 feet high. It yields three crops of leaves a year, which are made into tea. The young leaves and buds of the first crop gathered in May make the finest quality of tea. The leaves of the second and third crops, gathered later, make inferior grades of tea.

All the varieties of black and green tea come from the same species of tea plant, the difference being due to soil, climate, age of leaves, and mode of preparation. The black teas generally come from plants on mountain slopes, and the green from those in rich soil. The leaves are allowed to ferment in heaps for a number of hours in order to make the black teas, in this way acquiring the black color, and afterwards they are dried and rolled. To make green tea, the leaves are roasted when fresh and quickly dried and rolled.

The appearance of the older leaves when unrolled is quite characteristic, but to determine adulteration certainly a view of the cell structure is necessary. The epidermic cells vary in size and sharpness of outline. The stomata are all on the under surface and are very numerous; they are a little oval in shape. The hairs are on the under side of the leaf.

The Chinese use millions of pounds a year of the leaves of other plants to adulterate tea. They call the product by the significant name of "lie tea." The adulteration consists in the leaves of other plants, the dust of the tea leaves, sand, quartz, and magnetic oxide of iron. These are treated with a preparation of starch. Boiling water poured on tea leaves will cause them to unroll, so that other leaves can often be detected in that way.

There are a number of factories in this country where exhausted tea leaves procured from hotels and restaurants are fixed over and put on the market again. They are washed in gum and dried again, but they can be easily detected, because the roll of the leaf is less regular, and many flat pieces occur. They are also unnaturally glossy.

Graphite, Prussian blue, indigo, turmeric, etc., are used for giving color to tea. These can be detected by a low power of the microscope, which shows the clots of coloring matter separate and distinct.

Coffee is adulterated, and the easiest way to detect this is to examine the cell structure. Manufacturers have gone so far as to pass carrots, parsnips, chicory, acorns, and baked horses' and cows' livers through a machine which makes an imitation of the coffee kernel. The following specimens were exhibited to illustrate the subject of the paper: Tea leaves, both upper and under surface, ground coffee, chicory, adulterated mustard and pepper, also good and poor milk. Several drawings were also shown illustrating the subject, and some of the impurities in drinking and lake water were described.

The speaker then illustrated his method of mounting specimens in glycerine jelly, a substance which is fluid at ordinary temperatures, but stiffens when cold, and can then be readily confined beneath the cover glass by a ring of damar applied by the brush.

After refreshments had been served the Society adjourned till Aug. 9th, the place of meeting not being determined upon.

J. H. Jewett, Sec.

The Society met at the residence of Mr. F. F. Thompson, on Tuesday evening, August 9th, 1881. The meeting was called to order at 8:20 P.M., by the President, Major C. A. Richardson, and the minutes of the last meeting were read and approved.

Dr. Bennett then read a paper upon "Blood." This was brief but to the point, and it was finely illustrated. Blood was first described as a whole, and found to be composed of two portions, viz: the globules or corpuscles and the plasma. The weight of the blood is about one-fifth or one-eighth that of the whole body. The corpuscles form about forty per cent. in volume and the plasma the remainder. The corpuscles are flattened discs, which vary from one three-thousandth to one four-thousandth of an inch in diameter, and are about one sixteen-thousandth of an inch thick. The largest are found in the elephant, and the smallest in the musk deer. They are red in color, hence the color of the blood, and this is due to the presence of a coloring matter, hæmatine which consists largely of iron.

In man, and in almost all other mammalians, these corpuscles are circular in outline. The only exception is seen in the mals of the camel tribe. In birds, reptiles, and fishes they are oval in form and posess a nucleus. Beale, Flint, Dalton, and others maintain that they are homogenous bodies composed of soft gelatinous matter. Others, and among them Richardson, of Philadelphia, hold that they are sacks with a cell membrane, and fluid contents. The former theory is the more probable one.

They have the power of reproduction like isolated cells. Delicate radiating lines across the corpuscle are the first indication of the separation of one into several new corpuscles, and this process, it is affirmed, has been observed under the microscope. The oval corpuscles of birds, reptiles, and fishes, are much larger than the round ones of man and other animals. The largest are found in the Proteus, and are one three hundred and thirty-seventh of an inch in diameter.

There are white corpuscles found in the blood beside the red ones. They are less in number, however, the proportion being that of one white to 200 or 300 red ones. They are rarely less than one three-thousandth of an inch in diameter. They differ greatly in appearance from the red corpuscles, being granular and pale in color. They are separate and distinct from the red ones, and are not derived from them as some suppose.

Fibrine was described as one of the constituents of the plasma of the blood, and specimens were exhibited which had been obtained from the bullock's blood by whipping it with a bundle of twigs. After this the circulation of the blood was alluded to, and the power which keeps the blood in motion, as well as the so-called vaso motor system of nerves, which controls the amount of blood in the finest capillaries and smaller blood vessels.

Two live frogs were suitably arranged, under microscopes, so that the blood could be plainly seen circulating in the web of the foot. The corpuscles, both red and white, were also shown highly magnified. Fibrine was also placed under the microscope, and its peculiar structure shown. Dr. Carson exhibited some toad's blood under his microscope.

After the reading of the paper some discussion followed, and other members exhibited specimens. Major Richardson showed some beautiful grains of sand, which had been forwarded here from Yarmouth, Nova Scotia. Dr. J. H. Jewett showed the head of a common house fly, and also the diatom, Pleurosigma angulatum.

Mr. F. F. Thompson was appointed to give the next paper, and the society adjourned to again meet at his residence the second Tuesday in September.

JOHN H. JEWETT, Secretary.

EXCHANGES.

A field-glass, made by Brand Freres, Brussels, in good condition, to exchange for well-mounted slides, or for a good 1-6 or 1-8 objective. F. B. C., 519 Gates Ave., Brooklyn, N. Y.

Living Volvox Globator, in any quantity, for mounted algæ or other slides. St. Lawrence River or Northern New York algæ; desmids and diatoms for same, in other places. J. M. Adams, Watertown, N. Y.

Birds' eggs and whole insects in exchange for mounted objects of any kind, in good condition and well mounted. W. J. M., Box 201, Moorestown, N. J.

Fine fern-leaf copper crystals, arranged, and named diatoms; fine histological and pathological specimens; sections of teeth—the latter on the ground-glass slides, used at Geological Hall, Albany, N. Y. The above are all nicely mounted, and only first-class slides are required in exchange. Dr. Robt. Dayton, 559 Euclid Ave., Cleveland, O.

Wanted offers of new scientific Books in exchange for Leidy's rhizopods. H. M., 162 Fargo Ave., Buffalo, N. Y.

Will exchange mineral specimens of Idaho (for cabinet or microscopic use) for well-bound books of an instructive nature. Send list of books with particulars. John Chorette, Junction, Lemhi Co., Idaho.

Chara in fruit fully ripe, structure of sporangia, antheridia and antherozooids, easily shown, for the asking. W. W. Munson, Otisco. Onondaga Co., N. Y.

To exchange, scientific and miscellaneous books, for numbers of "Nature" previous to Vol. 19; "American Naturalist" for 1880 and previous to 1879; "Popular Science Monthly" previous to Vol. 12. C. D. Abbey, Wausau, Wis.

To exchange, for microscope slides and accessories, bound and unbound volumes of "The Scientific American." H. W. Belknap, Drawer 13, Hartford, Conn.

A 1-6 inch objective of 160°, adjustable (will resolve balsamed Pleurosigma angulatum by central light), to exchange for a higher power of narrower angle. Allen Y. Moore, Coldwater, Mich.

A few well-mounted slides of parts of insects, such as heads of flies, stings and tongues of bees, to exchange for other well-mounted objects. H. S. Woodman, P.O. Box 87, Brooklyn, E. D., N. Y.

Good uncleaned diatomaceous material, containing Arachnoidiscus, Heliopelta, Triceratium, Isthmia, Pleurosigma, Surirella Gemma, and Terpsinoe Musica, wanted in exchange for well-mounted slides of arranged diatoms, etc., or cash. Danl. G. Fort, Oswego, N. Y.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, England.

A Baker stand, also a new imported $12 Zither, to exchange for first-class objectives. Box 107, Astoria, L. I.

The Lathe and Its Uses, etc., for a Nobert plate or a Micrographic Dictionary. E. Pinckney, Dixon, Ill.

Wanted, a foreign microtome in exchange for a C clarionet, in good order and worth $35. T. S. C., Asylum, Toronto, Canada.

Wanted, diatomaceous deposits (about a bushel of each kind, by express), for good slides, material, or cash. Geo. B. Scott, Box 4,196, New York.

First-class slides, palates of marine molusca, and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens; lists exchanged. Rev. J. D. King, Edgarton, Mass.

Will exchange mineral specimens of Idaho for such books, minerals, curiosities, etc., etc., as I desire; Household Microscope wanted; state what you have to exchange, giving particulars. J. P. Clough, Junction, Lemhi Co., Idaho.

Selected and well-mounted diatoms, in exchange for other good slides, or material, etc. W. H. Tivy, 6th and Olive Sts., St. Louis, Mo.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Wanted, copy of Micrographic Dictionary, Second Edition, in exchange for Leidy's Rhizopods, etc. A., care Editor this journal.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

A German microscope, with 3 objectives and 5 eye-pieces, condensing lens, etc., resolving P. angulatum, will be exchanged for a first-class spectroscope. Clarence L. Speyers, 50 W. 17th St., N.Y.

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Some Observations on Pond Life.*

BY D. S. KELLICOTT.

DURING the greater part of July last I had the satisfaction and the high privilege of recreating in central Michigan. I regard it a pleasurable task to give an account of myself in the matter of field work with the microscope, as a loyal member of this club—certainly as a naturalist, and in love with nature, there is pleasure in expression. I was advantageously located on the banks of the Shiawassee River, near the city of Corunna. I was fairly equipped, having a good boat, a convenient outfit of nets, dipping bottles, pippettes, hand-lens, compound microscope and fixtures, and so on. My experience in preparation for this excursion leads to the remark that when one is packing up his "kit," there is usually surprise on account of the possession of so much goods, and also surprise that it takes so many things to do comfortably a little work. But, after getting really at work, I could appreciate my facilities, and was convinced that I had not taken trouble without return. While I am well aware that the amount of personal gratification and rejuvenescence was out of all proportion with the amount of fresh, new, or useful facts brought to light, still I have reason for hoping that I have compounded enough to interest you for the few minutes allotted to this paper, and perhaps that to some I have suggested desirable lines for observation.

At the outset, I shall refer to three very unlike forms, unlike in their nature yet closely alike in external appearance. They are the larva of a beetle, *Psephenus Lecontei*, The larva, or rather its case, of a neuropterous insect, and the shell of the fresh water limpet, the mollusk, *Ancylus fuscus*. Although they resemble so closely one another on superficial examination and occur in the same situation, in fact have all been taken in company, it is not apparent that any one of them is protected because it so closely simulates or mimics the others; yet careful attention to their habits and enemies may discover such to be the case. I am persuaded that some at least of so-called examples of protective mimicry recorded in the books, rest upon as vague notions of habits and occurrence as we possess concerning these forms. Indeed it is not difficult to make out a case. In the first place, there is pressing need of protection. There are scores of hungry mouths, attended by astonishingly keen eyes, incessantly seeking and remorselessly devouring every attainable soft-bodied larva or mollusk. There is no millenial peace down beneath the placid azure-reflecting bosom of the fresh waters. To capture and to avoid capture fill up the sum of aquatic animal life. Fortunately our size, intelligence and environment enable us to contemplate other qustions; the wonderful adaptations of living forms to their inevitable, their beauty, their simplicity, their complexity. All these and many more are for our study and delight. An aquatic insect larva, or uncovered mollusk, must escape the numerous active finny tribe, as well as the predacious individuals of their own "kith and kin," often their most dangerous foes. Why not then say our soft-bodied beetle larva, for protection has taken this particular form, mimicing its companions the shelled mollusk and the gem-cased neuropter. But without considering this question further, there is enough of interest attached to these animals to hold our attention and repay study.

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*Read before the Buffalo Microscopical Club Oct. 11, 1881.

The true nature of the larva of *Psephenus Lecontei* has sometimes been overlooked; by none more remarkably than by DeKay, who described it in Part I.—53, "Zoology of the Nat. History of N. Y.," as a crustacean, under the name *Fluvicola Herrickii;* he also gave a poor figure. He called attention to "the singular coincidence, that animals bearing so strong an external resemblance to trilobites should be found at the most remarkable locality in the United States for these extinct animals." DeKay did not suppose that they were of the same orders, but that they were allied in form. Agassiz in his "Lake Superior," page 241, describes this larva quite at length, but gives no figures; he obtained his specimens in the Niagara River. Mr. David F. Day has recently found them abundant in the river above the Falls. I have taken them this summer in the creek at Hamburg, N. Y., besides our Michigan locality. They owe their deceptive form to an uncommon lateral expansion of the skin of the back, so while the body of the larva has the usual shape and number of articulations, the animal appears as an oval, flat, yellowish green patch, reminding one quite forcibly of the *Argulus* so well known to us from the blue pike of our river. It clings closely to the wood or rocks, aided by the dorsal expansions which are edged by a closely set, rather ample fringe on their outer and front margins. I found the ends of mussel shells protruding from the mud, one of its favorite resting places. Agassiz says, "Its elliptical shield was firmly adherent to the stones by its ciliated margin, and forms an excellent protection under which the later transformations could take place with safety."

I refer now to one or two points in its anatomy. The respiration is by branchiæ, as in many aquatic larvæ; but its branchiæ are quite peculiar; they arise from near the posterior border of the ventral side of the abdominal rings; they consist of a main trunk, bent outwards a short distance above its origin, and bearing along its under-side ten long filamentous branches. These are waved to and fro in a manner that reminds one of the motion of the false feet of the cray fish, or of the similar branchial motion in certain neuropterous larvæ, particularly that of *Corydalus cornutus*. Agassiz gives the number of branchiæ as six, I can find but five on mounted specimens in my possession. He also says "that there is a large bundle of filaments connected with the anal opening, which may be retracted and ordinarily not visible in dead specimens." I am not able to find these in either dead or living specimens. I have found, however, a beetle larva of the same general form, living in company with it, which has such a branchial bundle, but it has no ventral branchiæ; species not known, probably, *Helichus lithophilus*. This one may be readily distinguished from the former by its outline, which is ovate or narrower posteriorly, and by four light spots on its back.

It is worthy of note, that the larvæ taken at

Corunna were all infested by a rotifer which literally covered and loaded their antennæ, legs, etc.

The second form of this triad, the beautiful shield or case of the *Neuropter*, is composed of quartz sand, in this particular locality of sand of many colors, firmly bound together. The oval shield is convex above and concave below, and on the under side of this one is another narrower, shorter one, which forms the cavity or pocket in which the insect resides. As it grows it cements rows of sand grains about the edge of the upper plate and along the front edge of the under one; as the larva cannot easily reach the posterior end of the shell, the growth is anteriorly and laterally, so the older ones are somewhat fan-shaped. Seen from above there is a small opening at the posterior end of the upper plate.

The third form, *Ancylus fuscus* (?) was common enough on flags, bulrushes, and stones; is abundant, too, in the Niagara, especially in autumn, on water-weeds. A thin, clean shell affords a good opportunity to observe the heart's action and other interesting points.

I mention next the *polyzoa* observed. Only two species could be discovered, while at least seven species were identified from the Niagara during August and September. These species are *Paludinella Ehrenbergii, and Plumatella diffusa.* The former occurs on stones and other objects where there is considerable movement of water; it prefers darkness, so it is almost invariably on the under side of its support; its fine, brown, hair-like tubes resemble so closely the roots of aquatic mosses among which it grows, that we must know it and search for it or it escapes detection. This sensitive species must be removed to the microscope with much care, or it will not spread its tentacles until after hours. But when it does come out from its tube it is an exceedingly beautiful object. This species appears to be very widely distributed. Allman thinks that the American species are identical with the European. *P. diffusa* was abundant enough under snags, and in a few instances it was taken from the pond lily. When these slender, brown, branching tubes were carefully removed to a capsule of water the animal soon displayed its beautiful proportions. Allman says, "Among the most beautiful and interesting forms of invertebrate animals, are those strange phytoidal animals which, long confounded with the polyps, were at last separated as a distinct group and described by Thompson under the name, Polyzoa, and shortly after indicated by Ehrenberg under that of Bryozoa." It is strange that these creatures have not called forth more study and mention in this country. The bibliography is meagre; the writings of Dr. Joseph Leidy and Prof. A. Hyatt embrace about all that we have to consult.

Of the several kinds of eggs studied and determined, only one or two are referred to here. The eggs of *Donacia confusa* occur on the under side of pond lily leaves. The beetle, it appears, makes a round hole in the leaf, through which the abdomen is passed from above and the ova placed in a circle, not often complete, about it. The egg is oblong, length, ·032 of an inch; the white gelatinous covering binds them firmly to their support, it extends considerably beyond them, and when the mass is examined with a low power, each ovum appears nearly in the middle of a wedge-shaped mass, ·6 of an inch long. It may be worth mentioning, that the larva of this beetle may be found in the autumn clinging to the roots or rhizomes of the water lily. They cling in a peculiar way; from the upper side of the last ring project two brown spines, by bending the posterior extremity these spines are brought in front of the larva and thrust into its food plant. In the spring they spin impervious brown cocoons, attached to the lily root like fruit; in these the larva transforms, the beetle appearing in June. I have said the egg and larva above are those of *D. confusa,* because that species was common on the lily leaves at the time the eggs were taken.

Let us next consider an infusorium imparting a crimson color to the water inhabited by it. On approaching a pond caused by some operations of the coal miners, I saw a few inches from the margin, over a sandy bottom, a band of bright crimson extending several feet. The dipping bottle soon showed that the color resulted in the water; the microscope proved it due to a ciliate infusorium present in vast numbers. It was cylindrical, varying much in length, viz., from 1-5000 to 1-3000 of an inch; the shorter nearly straight, the longer curved. They were very active; self division was noticed in many instances. They proceed through the water with a rolling movement; the longer curved ones with this peculiar motion: the anterior end rotating about the line of progression at some distance from it, the posterior about it as an axis. They remained alive imparting color for several days; it gradually faded until the infusoria had disappeared.

A week later the color had disappeared from the pond.

Next, a word about some guests of a cray fish. One large cray was put into a small pail of water, when the few individuals at first seen, of the interesting *Brachiobdella parasita* turned out to be the outposts of a great company; as soon as the water became stale they assembled about the head and antennæ of the cray in such numbers that these parts were covered by a waving fringe. September 10th, I took crays in the Niagara equally infested. This parasite is near to, if not the same as, the European form named above, but the egg is quite different from those of that species as figured by Dormer. The egg of this one is longer (·01 of an inch) than wide (·008 of an inch), instead of being spherical; the pedicle is also shorter. The young do not escape by a lid but push out the shell as a silk worm pushes out its cocoon. The young leaves the egg tail first; when it is remembered that it is a leech with only one sucking disc, the reason is obvious. There are other differences, notably in occurrence, the jaws, etc., which differences I shall state at another time. Temporarily I call this parasite *Brachiobdella cambari.* On the same cray I found a *Cothurnia,* which proves to be *C. astaci* of Stein, although this species occurs on *cyclops,* etc.

Permit me to speak briefly of certain fish observed. I found one quite interesting Lernæan not before reported on our river fish. It occurs on the red-fin or rough-head, *Luxilus cornutus.* It closely resembles *Lerneocera tortua* which I found on the bullhead last year. It prefers to fasten just back of the pectoral fin, but rarely under other fins. I obtained the young. I also mention finding *L. cruciata* which is common on the rock bass, on the sunfish or bream. I found the black bass infested by a "grub." The so-called grub is a *Distoma,* it occurs incysted in the muscles, gills, etc.; it is easily set free, when it moves about for some time in the water, a flat, oblong, white worm a quarter of an inch long. It is distressing to know that so fine a fish harbors so mean a guest. The bass is not without compensation, however, for the fishermen regard them unfit for food when thus infested, so that many thus escape the fryingpan. I have not thus far met with an external parasite of this fish, it has several internal ones besides the *distoma.* A moderate sized fish was taken which appeared rather lean; on examination of its intestines, the corea especially were found to contain large numbers of an *Echinorhyncus* worm, yellowish white, from ¼ to ¾ of an inch long. It may be called to mind that the sexless stage of these worms is found in the invertebrates, the mature form with the vertebrates; the fish probably took them into its stomach with some crustacean.

I refer in conclusion to an interesting form so far unknown to us at Buffalo, viz., the *Wolffiæ,* the most minute of the flowering plants. This plant is so abundant in ponds about Corunna that thick layers are often met with. I brought home a quantity of these emerald gems, which were planted in a pond between Fort Porter and the Erie Canal. Should this planting succeed in establishing this lovely form among us, I shall claim a reward—the gratitude of my microscopical fellows.

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A Month's Pond Hunting.*

IN my personal work for the month, I can report having found many interesting and some rare specimens along the shore of Niagara River. The stones and algæ have been covered with microscopic life to an extent surprising and gratifying to the microscopist.

My attention has been attracted by the many kinds of rotifers, presenting themselves on almost every occasion. I discovered some fine specimens of the cephalosiphon Limnias, a tube dweller with a single antennæ of extraordinary "length and versatile power" (Hogg). The case in which it lives is not near as beautiful as that of melicerta ringens, but the animal is very active in its motions and has many points of interest not common to rotifers.

The long antenna is first thrust out and is moved rapidly to and fro, as if to explore the surrounding water for safety. Slack, in his "Pond Life," gives a figure and description. Hogg also speaks of its remarkable character. The Micrographic Dictionary considers it a doubtful genus of Rotatoria. The correctness of this opinion, the time at my command will not allow me just now to investigate. I found also colonies of the "megalatrocha flavicans," as described in the Micrographic Dictionary. A single animal is about the size of the rotifer vulgaris, but is very different in construction. It has but one rotating disc, which, however, is large and horseshoe-shaped, displaying the ciliary movement in a remarkably beautiful manner. The common rotifer, you know, is free, and is a very lively fellow when it pleases him. The megalatrocha are in colonies, by estimation of about 250, attached nearly to one point on a branch of nitella. The attachment is at the posterior extremity, and as the head is the larger part they radiate from the point of attachment forming a most beautiful object. They are very lively, and keep up a constant play of their cilia until something occurs which we cannot account for, when they all collapse instantly for a second or two, then as rapidly renew their movement. The species of nitella upon which I found these and many other of the infusoria is quite new to me. It is very large but very transparent, showing the movement of the circulating fluid with great clearness. Among our four species of sponges, I find those which are known among us as spongilla asperrima and carterella tubisperma, more common than the other two varieties. Previous to this season, C. tubisperma was found only in fragments sufficiently large to enable us to identify the species. This year we have found it as large as one's hand and nearly two inches thick. S. ottawaensis presents itself more vigorously than ever before, although the specimens found are still small and fragmentary. I have seen many fragments of S. Fragilis, but they were too small to be worth preserving. All the known species in this vicinity are infested with numerous carnivorous worms, either as larvæ or as full developed aquatic animals. These devour greedily the infusoria, amœbæ, and sarcode of the sponge, so that especially in the case of ottawaensis all that we can find is a mass of spiculæ and statoblasts riddled through and through by the carnivoræ before named. Statoblasts of sponges are what have been variously named egg cases or ovarian capsules. Each capsule has an opening for the escape of its contents at the proper season. In our C. tubisperma the statoblasts have not merely an opening or foramen, but the opening is extended by a tube about as long as the diameter of the capsule. To each of the tubes there are branching finger-like processes, tendrils, or tentacle-shaped branches, varying in number from three to ten on each tube, terminating in rather poorly defined hooklets. There are only three varieties of fresh water sponges known to have these tubes and processes or anything resembling them. Two of these species are found in Philadelphia and one in Buffalo, and as their peculiarities are so marked the discoverers of them felt justified in establishing a new genus. For this purpose it was deemed best to consult a certain acknowledged authority on this class of objects. To the very great surprise of the parties interested, this gentleman pronounces the tubes and tentacles or tendrils to be parasitic. The parasite he considers to be akin to the spongiophagus of one of the marine species. We do not know upon what grounds he bases his conclusions, nor do we see how such a conclusion can be arrived at with the objects before us. We have mounted many of these statoblasts in various ways. The most successful plan adopted by myself has been to cut sections of the statoblasts so as to trace the origin of the tubes and their relation to the inner coatings of that body. The statoblasts consist of three coats or walls. The outer coat is a thick crust made up of some whitish granular substance, the precise character of which is not known. It is held together by a number of what are called birotulate spiculæ placed radially, all pointing to and from the centre. These birotulate spiculæ may be compared roughly to double-headed rivets, the heads in this species being stellate in form. These give great strength to the wall, and render it admirably adapted to protect, during winter, the other coats, as well as the more important germinal matter contained therein. The next coat is thin, transparent, and generally amber-colored. It is called the chitinous coat from the supposed nature of its composition. The inner coat containing the eggs, or what are equivalent to eggs, is very thin and delicate, and might be overlooked except by a very careful observer. To protect this delicate membrane and its contents from any abrasion against the inner ends of the birotulates, the second, or chitinous coat is interposed, and in every instance where the sections have been cut so as to allow it to be seen, we find that the tubes and their attachments are merely a continuation of this chitinous coat. I have prepared some slides of statoblasts simply by crushing them on the slide after they were mounted in balsam. By this process, in many cases, the outer coat has so parted as to expose the chitinous coat and tubes in their entirety. Another convincing argument against the parasitism of these tubes, is the universality of their presence on the statoblasts of all three of the species. If some were infested and others were free, we might then, at least. suspect the presence of parasites, but every statoblast has the attachment peculiar to its species, without any exception so far as we have seen. As the manner of making these sections may be interesting to those who may wish to examine these objects for themselves, I give my plan. Select a suitable piece of sponge having plenty of statoblasts, wash out any extraneous matter in a tumbler of water; then take the sponge and dry it for a minute between pieces of blotting-paper. Afterward remove it to your section-cutter, secure it in place by two or three pins, or anything convenient, if necessary, then imbed by pouring on hot parafine. When quite cold and hard, cut into sections, putting the cuttings into hot water. The parafine will then melt, and sections of statoblasts and spiculæ will fall to the bottom. Let all stand till quite cold; the parafine can then be removed and the sections taken out and mounted as desired. By this process, I think it will not be difficult to cut sections of some of the larger diatoms. In concluding this short paper, allow me to say to the younger members of the club, that they will find it to their incalculable advantage, to record the observations they make with the microscope, accompanying their remarks with drawings, even though they may be of the rudest kind. In this way, forms and particulars will be impressed upon the memory so as not soon to be forgotten. This is a characteristic trait of all great observers.

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* A paper read before the Buffalo Microscopical Club, by Henry Mills, Oct. 11, 1881.

The Use of the Microscope in Consumption.

DIAGNOSIS OF LUNG NECROSIS AND DISINTEGRATION.

BY EPHRAIM CUTTER, M.D.,
New York, late of Boston.

IT is a familiar fact that in consumption generally (not always) the lungs break down in their structure, leaving cavities, and thus are wasted and consumed; hence the name of the disease. Opinions of students of all ages vary as to the cause. The best opinion the writer knows of is that of Dr. Salisbury, in which he compares the ravages and tissue destruction in pulmonary consumption to the ravages of dry rot in timber, both being caused by fungus growths or vegetations. This is not the place to go into the history of the macroscopic and microscopic evidence that sustains this position, only the writer would bear witness to the truth of the position. It is our object to impress the fact that when the lungs break down in consumption this necrosis and sloughing is positively shown by the use of the microscope more decidedly and long before, in some cases, than by any ordinary physical sign of exploration. Again, by the use of the microscope we can tell whether the lung disintegration is being arrested (for this is arrested sometimes), and whether the necrosis has ceased to exist.

These points are of vital interest subjectively and objectively, and make an enthusiast feel like exclaiming, "God bless the makers of microscopes!"

In the case of the timber rot some of the connective fibres of the woody tissue resist the decay longer than others. Thus we have timber retaining its form and performing its duty, while none of its ducts and liber fibres are decayed. This results from the fact that the connective fibrous tissue of the vegetable parenchyma does not decay so readily, and holds out longer. It is so with the lung rot. The spongy nature of the lung is due to its histological elements embracing and being built up of elastic connective fibrous tissue that form the contractible and expansible network of the air cells.

Now, the *anatomical* demonstration of these fibres is not an easy matter, or was not in my day. But the pathological demonstration in a case of consumption is not difficult. The disintegration caused by the fungus vegetation dissects out the connective elastic fibres with beautiful nicety and accuracy—as we see in vegetable dissections made by the processes of digestion undergone in traversing the alimentary canal of a heifer or of man. The soft parts are removed without disturbing the anatomical position and relation of the fibres, so that notwithstanding the physical disturbances met with in expectoration we often find the broken ovals of the air lung cells as perfect as it is possible to conceive them to be, and gives rise to complete coincidence with the inspired utterance: "I am fearfully and wonderfully made."

Now, if an honest investigation of the sputa of a suspected consumptive reveals the presence of curling fibrous tissue arranged in ovals with one-quarter of the periphery broken out, or portions of such tissue not so symmetrically arranged, and such curling fibres don't polarize light, it is positive human evidence that the lung tissue of the person expectorating is *breaking down*, and some opinion as to its nature and extent can be formed by the abundance or paucity of the fibres.

Again, patients at a distance can forward their sputa for microscopical examination, and a great deal of positive evidence as to the real pathological condition of the lungs can be at once obtained, and besides information given as to how the patients are progressing.

Again, impending hæmorrhages can be foreseen and light thrown on many practical therapeutical points that turn on the presence of destructive interstitial lung necrosis. The gentleman alluded to above, the writer and others have thus found the microscope to be of priceless use. It remains to tell how the sputa is examined:

First Method (Salisbury's).—Things to be had: 1. A positively good compound microscope, 1 and 1½ inch eye-piece, ¼ or 1-5 inch objective (Tolles's objectives answer perfectly, and this is said without disparaging other makers). 2. A clean slide. 3. A clean cover. 4. The sputa from the consumptive. 5. Two bistouries. 6. A teacup.

Mode.—The sputa is put into the cup. The bistoury is engaged at its point in the sputa. The sputa is drawn up and out like a stick of molasses candy. Then dexterously a small portion half the size of a pea of what appears to be a dense part of the sputal cylinder is removed by the other bistoury and placed on the centre of the slide, 2. It is then covered with 3, and evenly diffused in one uniform film under the cover. Any excess of sputa outside the periphery of the cover is removed by a bibulous cloth or paper. The specimen can then be turned in any direction, and it is then placed under the microscope and examined as any other object. Probably no individual has examined more specimens of human sputa than the author of this plan.

Second—Method of the Writer.—Possibly of not importance enough to mention, but as this is history it is named as practiced by myself.

A. Things to be had: 1, 2, 3, and 4, same as above. 5. Two common wooden toothpicks, clean, or, 6, wooden matches.

Mode.—Same as above stated, save that toothpicks replace the bistouries.

Remarks.—Toothpicks are so cheap that new ones can be used each time and thrown away. Their comparatively rough exterior when dry makes them "catch" the slimy mucus, we think, better than steel. They require less care and are less dangerous. Same remarks may be made of the proximal end of common lucifer matches.

B. In the study of the fauna and flora of hydrant drinking waters, I use a cell with brass side and with a glass bottom. Size, about 2½ by ¾ by 1-16 of an inch. In connection I use a nice low-angled ¼-inch objective of about ¼-inch working distance. This combination allows the disuse of a cover and gives a much larger field on the stage to explore. When used for sputa the latter is deposited in the cell and teased out into an even film all over the bottom of the cell. It is made so thin as to expose the whole substance to examination, and is rather less trouble than mode A, as it does away with the use of a glass cover, which is liable to be broken, but it involves the use of the horizontal stage. I use an Amici stand for *this work*, not caring if it is old fashioned, as it is easily and comfortably employed, more so than the best Zentmayer in this special instance. The sputa may be placed on a common slide also.

Third Method.—Boil the sputa with an equal bulk of caustic soda in solution (20 grains to the ounce of water), and examine the sediment. This is Dr. Reginald E. Thompson's mode, taken from his work on the "Physical Signs of the Diseases of the Chest"—H. Renshaw, London, 1879—the best, most compact, and most admirable compendium we know of.

Diagnosis—Polarized Light.—Of course, as the sputa may come from any part of the air passages, and as foreign substances floating in the air are apt to be inhaled, it is expected to find in the expectoration many things normal and abnormal. The diagnosis is based on: 1. Internal evidence. The tissues are so characteristic as to be *sui generis* and recognized at sight, like a rhizopod or a desmid, for example; but should a fibre of cotton, bast, or linen fibre be so macerated in the expectoration and rolled in its movements as to break up into fine fibrillæ they may become twisted, and so disposed singly and collectively as to resemble lung fibres.

2. The polariscope decides at once, as the lung fibres do not polarize light. Also the detection of starch coming from the food is easy. Thus lately I detected a patient in eating potatoes, which she had

been restricted from in the diet. The following are among those things found in the examinations of sputa for elastic lung fibres in suspected cases: 1. Cotton fibre. 2. Silk fibre. 3. Linen fibre. 4. Wool fibre. 5. Pitted ducts. 6. Amorphous organic matter. 7. Dust and dirt. 8. Mucus corpuscles. 9. Do. distended with cystine (Fig. 2). 10. Epithelium ciliated and not ciliated. 11. Asthmatos ciliaris. 12. Crystals of cholesterin. 13. Cystine. 14. Skeins of mycelial filaments. 15. Yeast sporangia. 16. Swarms of spores. 17. So-called bacteria. 18. Mycelial filaments of fully developed yeast and other fungi. 19. Leptothrix buccalis. 20. Potato starch. 21. Blood-red corpuscles. 22. Muscular fibres of food. 23. Starch, wheat. 24. Hairs. 25. Portions of feathers. 26. Pus. 27. So-called granular tuberculous matter, sometimes fetid in odor. 28. Spirillum. 29. Vibriones. 30. Micrococcus spores. 31. Gemiasma verdans. 32. The whole lumen of a vein just before ending into the capillary. 33. Uric acid. 34. Oxalate of lime. 35. Lung calculi made by some of the bodies named. 36. Vegetable food elements, etc.

The amount of sputa or its physical characters macroscopically do not always indicate the presence of lung fibres. Sometimes a surprise meets one, as lately in the case of a good-looking, medium-aged and sized woman, with but a few marked physical signs of consumption, when requested to spit, raised some white aerated and frothy mucus, which was supposed to come from the throat, and yet was found filled up completely with curling fibrous tissue. The expectoration was what is usually called a "small spit." This demonstration showed the microscope to be far ahead of ordinary physical signs. When one considers the prevalence of consumption, its fatality, and the acknowledged importance of an early and accurate detection of the organic lung lesion for diagnosis and (we affirm) treatment, we think we do right to call attention to the indispensable use of the microscope in the study of this human excretion in consumption. Histology, urinology, are important departments of observation, and are properly sedulously cultivated, but if we have said anything to impress the importance of microscopical inspection of sputa as an object of study in consumption we shall feel rewarded for our pains.

We know it is revolting to deal closely with a nasty excretion which for ages has been regarded as a vehicle of the expression of the most profound contempt and despite a human being can manifest to another. Yet, by the use of the microscope, this "spittle" can be made the vehicle of positive and useful knowledge of diseased conditions, and sometimes awaken feelings of æsthetic pleasure by challenging our wonder and admiration of the exquisite skill of the Creator in making out of the right physical materials the minute air cells of our lungs with such marvellous perfection that even when ruined in disease and death they give inimitable evidence of designs for special ends

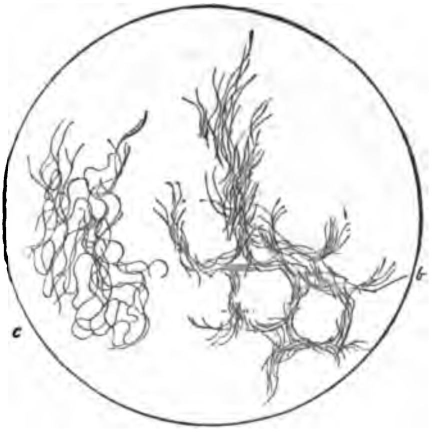

Fig. 1.

Fig. 1, drawn by Dr. A. T. Cnzner, is a specimen from Dr. N. Willis Terry, Terrytown, Pa.

a. Elastic lung fibres from sputa, somewhat teased out. *b.* Do., showing the same, less teased out, and displaying the beautiful network of those air cells, one of which is open more than one-third of the periphery.

Another, less broken open, while a third is apparently complete in its periphery, owing to the point of view and collection.

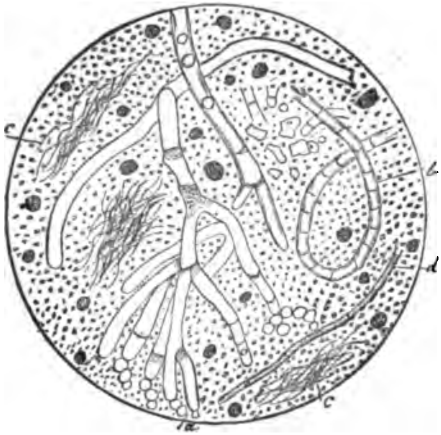

Fig. 2.

Fig. 2, consumption sputa—Mrs. J. R. Hews, Boston—shows three fungus vegetations in full development. Sputa came from an immense cavity of the left lung, where the access of air was free.

These mycelial filaments are the result of a natural culture from the swarms of spores which most writers choose to regard as ultimate forms of development. *a* is a beautiful collection of large mycelial filaments with fructification, and is probably the full development of the vinegar yeast found in the blood of consumptives.

b is an isolated filament, do.

c, a collection of mycelial filaments remarkable for their tenuity and subtleness. Not regarded as peculiar to consumption, as we have found them in the sputa of a case of croup and a peculiar case of chronic asthma. It resembled a leptothrix in skeins.

d is an intermediate form of fungus vegetation. Under the microscope it had a tint of lurid red, and made an ugly impression. This form is new to me.

Scattered through the field are little dots much larger than the original. These are present in countless swarms and are automobile when there is an opportunity. These we look on as the embryonic fruit of the fully developed vegetations represented.

The large ovals and circles filled with granular matter we look on as collections of inorganic matter distending the enlarged mucus corpuscles. Usually we have regarded them as made up of cystine, carbonate of lime, uric acid, etc.

These specimens were cultivated farther in a zinc box just large enough to receive a dozen slides. The lower ones were kept wet with water, and the specimen slide preserved on top in an atmosphere that would be moist so long as the water remained unevaporated. In this manner the specimens were kept over two weeks and carried to Boston, where Dr. G. B. Harriman, my associate, verified the observations here given.

246 West Forty-fourth street, May, 1881.

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A Paramecium Astray.

BY W. H. WINSLOW, M.D., PH.D.

President of the Pittsburgh Microscopical Society.

"ETERNAL vigilance is the price of good microscopy," as every one knows who has worked over the tube. I had an excellent illustration of this during an examination which I made of a cancerous brain. The patient had gradually lost the sight and hearing of his right, and afterwards of his left side, but had retained his mental faculties almost unimpaired till a violent convulsion cut him off at the age of forty-five years. I made the post-mortem for the distinguished practitioner, who requested me to make a careful microscopic examination of the brain, to illustrate his report of the case. The left side of the brain was nearly normal, the ganglia at the base were altered by softening and hæmorrhagic foci, and the right anterior and middle lobes were hardened in the cortex, but softened centrally to such a degree that I found great difficulty in removing the hemisphere without losing the semi-fluid contents.

Several sections were made and examined before anything characteristic was found, and I concluded to study the grumous semi-fluid of the central part of the brain. A clean slide was taken, a drop placed upon it and covered by a clean glass. The mount was too thick to show well, so I took a pipette and transferred a drop or two of water from a glass upon the table. The result was not satisfactory, and I dumped the slide into a basin. I took another slide and cover, cleaned them well, put a drop of the brain mush upon the slide and two drops of water, and covered. The elements were distinguishable: granules, free nuclei, red corpuscles, pus corpuscles, fibrillæ, fusiform, oat-shaped and stellate cells, alveolated masses and amorphous débris. The fluid was running across the slightly inclined slide, and smaller objects were running and turning in a lively manner. I took a *coup d'œil* of the floating particles, when, horror! what did I see? A living, animated, lively being, a real animal. He was swimming around amongst the islets of destruction, apparently well satisfied with the nutritious juices that washed their shores. Was it an animal, though? It looked somewhat like ciliated epithelium. The cell was nearly oval, contained a nucleus and nucleolus, and a fringe of cilia. The cilia could not all be seen always, but there was a modification of one end of the cell into an unmistakable head. A ciliated cell with a head, an animal with a nucleated and nucleolated abdomen, what could it mean? Visions of Hogg's, Carpenter's, and Cobbold's pictures passed in a panorama before my mind. The flush of an excited discoverer swept over my brow. The feeling of Archimedes when he shouted "Eureka!" overpowered me, and I sank into my chair. I, an amateur microscopist, had made a discovery that would render me famous, and hand my name down to posterity. How the medical world would be astonished at my discovery that cerebral cancer was parasitic; how naturalists would wonder at the production of a new species! I took another look. Several other bodies answering the description given above were focused. Slowly the fact dawned upon me that I had beneath my objective a vulgar Paramecium. Hogg figured it exactly. I had used water from a vegetable infusion that stood alongside the distilled water glass. My visions of mundane glory vanished. I prepared a new slide with *distilled water*, and went on with my study of the morbid product.

Striæ of the Diatomaceæ.*

THE Count (Abbé) Castracane has published a paper under the title "On the value to be attributed in the Determination of Species to the number of the Striæ of the Diatomaceæ," of which the following is substantially a full translation—the original paper is written in Italian.

"One of the most fortunate epochs for sciences of observation is, without doubt, this half of the nineteenth century, when, the attention of theoretical and practical opticians being applied to the construction and perfecting of the microscope, a new path has been opened for this instrument with a more brilliant future, thanks to Professor Amici and his invention of immersion objectives. Objectives of the highest magnifying powers will now give greatly improved images as regards spherical and chromatic aberration, and beyond all other advantages realized in this way, a much more valuable victory and a much greater progress was the extent of the angle under which the object could be illuminated. It is thus that organisms presenting details of exquisite fineness, and which seemed to defy all power of resolution, have been shown and distinguished from one another by the use of very oblique illumination, so that this angle of aperture of objectives is the principal factor of their value.

The acquisition of an instrument of research so interesting and so efficacious, has led to the discovery of unexpected wonders, and the microscope has become the inseparable companion of the naturalist, the physician, the botanist, the physiologist, and all those who endeavor to recognize the ultimate forms and the minute structure of organisms and tissues. The microscope has opened new fields to the insatiable curiosity of mankind thus drawn towards the study of the wonders of the microcosm. Amongst the latter must certainly be reckoned the diatomaceæ, the knowledge of which, we may say, only dates from the time when the improvements of which we have just spoken were introduced into the construction of the microscope. This revelation has furnished the most abundant harvest of discoveries to those who have devoted themselves to such researches, and it is not surprising that Ehrenberg, Kützing, Smith, Brebisson, Gregory, Bailey, and many others, have been able to recognize so large a number of diatoms, whilst all those who have occupied themselves seriously with this study know that the discovery of new genera and new species is not very difficult, although the selection of these new species is far from being perfect.

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*Atti Accad. Pontif. Nuovi Lincei, xxxi., Sess. VI., 26th May, 1878.

But the work of those to whom we are indebted for the knowledge of thousands of forms of the diatomaceæ must necessarily suffer the consequence of the rapidity with which the number of the new organisms has increased. Accordingly it is not astonishing that an identical form or type has often been distinguished by different names, whilst forms different in appearance, and consequently known under different names, are now recognized, after more attentive observation, as belonging to one and the same species, and must consequently be united under the same name. But this constitutes the most ungrateful and arduous task to which we can devote ourselves. It is necessary to know the value of the characters by virtue of which one form may be entitled to be recognized as a specific type, and to eliminate those which may not be equally legitimate. It is thus that we may be able to terminate the confusion which reigns in the nomenclature of the Diatomaceæ, and which forms the greatest obstacle to those who have attempted to undertake their study.

But what are to be the rules to be followed in so delicate a research? in other words, what are the diagnostic characters of the diatomaceæ by which we may distinguish them from one another specifically? Such is the question which I proposed to myself when I undertook to study seriously this interesting order, and that is the subject which has kept me the longest time in suspense. In fact, every one admits that there is nothing more difficult in nature than the determination of species and the fixing of their exact limits, and some have founded on this difficulty an argument for denying the existence of these limits. Without dwelling on the absurdity of such a doctrine, which would annul at a single stroke the work of our predecessors in the study of nature, and would destroy science itself, I will show how the ordinary difficulties in the determination of specific characters have been increased by the extreme smallness of the organisms, in consequence of which it will never be possible to isolate a living form, to watch its successive evolutions, and to determine thus the independent characters of the organic evolution. Such characters, recognized as constant and invariable, would constitute bases for establishing the scientific characteristics and determining the distinct and autonomous types.

In such a state of matters, and awaiting the time when the means of making a diatom grow in a narrow cell shall have been discovered (as the mycologist makes the lower fungi grow in a moist chamber), let us see what are the characters which these wonderful organisms present—such of the characters as provisionally at least may serve for the determination of the species. It will be wise to occupy ourselves with only one point at a time (when several present themselves which are equally difficult), and we will content ourselves with dealing with striation, which distinguishes nearly all diatoms, and which forms the most beautiful and most curious part of their ornamentation. This striation is precisely that which most strikes the attention of the observer, and on that account, as soon as ever the diatomaceæ were studied and described, the striation was the first point that was noted, and then an endeavor was made to determine its fineness by calculating how many striæ are contained in a given space, as in the 1-100th of a millimetre.

So long as the diatoms were not too small, and above all, that the striation did not require the highest powers of the microscope and the most delicate disposition of the illumination, there was not much difficulty in determining the number of the striæ contained in a given space; but when the progressive improvement of the microscope enabled the granulations of the *Grammatophora*, *Pleurosigma*, *Nitzschia*, and *Amphipleura* to be distinguished, the attempts which different observers made to measure the fineness of the sculpturing led to very discordant results. The authority of these observers prevented the differences in the measurements from being attributed to errors, and this was the origin of the opinion that the number of the striæ comprised in a given space is not constant, and could not constitute a proper character for the determination of species. But the divergence in the results obtained often arose from the fact that types had been taken for measurement which were not really identical, and did not belong to the same species or variety. Moreover, one method of measurement had deplorable consequences. It is thus, for example, that Messrs. Sollitt and Harrison, of Hull, in affirming that they had found that the number of the transverse striæ of *Amphipleura pellucida* is not less than 120,000 per English inch (5,200 in a millimetre), have certainly fallen into error, for, notwithstanding the important progress which has been made in late years in the magnifying power of the microscope, we have not arrived at anything beyond the definition of the striæ, and moreover, such a number of striæ notably surpasses the limit of visibility, as Professor Helmholtz has recently established. The method of measuring by an eye-piece micrometer would be the best (as certainly it is the most rapid), if at the same time it was free from error. But when we deal with details of an excessive fineness, and such as almost defy the resolving power of the most perfect and powerful objectives, it is extremely difficult, and leaves room for a great deal of error, to determine with precision the exact number of striæ comprised in a division of the eye-piece micrometer, the number of which is the smaller as the magnifying power is the greater. When we multiply this number of striæ comprised in a division of the micrometer by the value of that division, the probable error will become so much the greater, and such that the result may be far removed from the truth. It is thus that the two microscopists above named have been led into error by the employment of a bad system of measurement as regards the striæ of the *Amphipleura*, the number of which they have given much beyond the truth.

Thus the difficulty in the determination of the number of striæ in a given space, on the valves of the diatomaceæ, the disparity in the measurements made by different observers, and at the same time, the fancy of those who will not admit the existence of species (these, although devoid of every positive argument, and not basing their objections upon experience, affect to consider every organic form as accidental, and as a transitory state of an organism in actual and incessant evolution), all these circumstances have contributed to their denial of the value as regards specific character in the number of the striæ on the valve of a diatom.

By way of proof of this assertion we may cite the interesting discussion which took place* on the supposed identity of *Navicula rhomboides* Ehr., *Navicula crassinervis* Breb., and *Frustulia saxonica* Rab., a discussion in which Dr. Dallinger, Dr. Wallich, and Messrs. Slack and Ingpen took part. This controversy arose, less from the point of view of the study of the diatomaceæ than in regard to the adoption of their valves as tests for the quality of objectives. In this discussion the illustrious microscopists, Kitton, in England, and Professor H. L. Smith and Colonel Dr. Woodward, in America, added the weight of their authority before the Royal Microscopical Society of London, at the meeting of the 6th December, 1876, on the occasion of a paper by Dr. Dallinger. The very great analogy which exists between these three types is evident and undeniable, but from this analogy can it be concluded that there is identity? Though I may be taxed with temerity, I will take the liberty of replying to this pleiad of illustrious naturalists that this deduction does not seem to me to be just, and that if we are to rely on such arguments in the study of nature we shall soon upset all classification and destroy all notion of species. Being obliged by the extreme smallness of the organisms to content ourselves with reasoning on that which materially and actually appears to our eyes, supplying by inferences from probability the want of reliable arguments furnished by experience, it seems to me that we must consider the following reasoning sound: When in a sufficiently abundant and pure collection of diatoms several forms resembling each other shall be found, which by numerous specimens of different sizes represent a continuous gradation between the two extremes of the series, then only shall we be able reasonably to conclude that these different forms belong to a single species. Whence it results that a deposit of fossil diatoms can never furnish a basis for probable deductions on this matter, since in this case we have to do with a singular mixture of species of different genera, and not with an assemblage which can be considered as the components of a single stock or family, or of the same generation.

To be continued.

Dimorphism.*

BY DR. HERMAN H. BEHR.

It was about the year 1840 when the great Danish scientist, Steenstrupp, publicly declared that at different times he had seen an infusorial animal fasten itself to the object glass of the microscope and grow out into an alga.

The learned professor had witnessed this transformation several times, but still doubted what he had seen with his own eyes.

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*Mon. Micr. Journ., xvii. (1877) pp. 1, 73, and 173.

*A paper read before the San Francisco Microscopical Society, August 8th, 1881.

In the year 1847 Count Suminski, when he studied under the microscope the prothallus of Aspidium Felix mas, observed a swelling and consecutive bursting of several marginal cells. Each cell evacuated a little body, first spirally curled up, and when at liberty moving in the screw-like manner of some infusoria over the disc of the prothallus, in the direction of an entrance leading into an excavation containing a globular cell, nowadays called the oösphere.

Only one of the infusoria-like bodies entered this globular cell, and developed root and first leaf of a young fern.

In the meantime Professor Steenstrupp had recognized in the infusorium transforming into an alga, the Zoöspore or moving germs, of an alga, and in the course of his investigations had discovered in marine animals what we now call dimorphism, and which the Danish scientist published in an essay, "der Generationswechel oder das Ammenwesen."

From the publication of this little pamphlet dates a new development, not only in natural history, properly speaking, but in all provinces of physiology and biology. The accidental discovery of what appeared in the beginning, merely the peculiarity of a few low marine organisms, led to the revelation of that most mysterious of all biological processes, the reproduction of the species. It is true neither Professor Steenstrupp nor Count Suminski had an idea of the vast importance of their respective discoveries, nor did they foresee the enormous change of views that gradually was to take place in all the different disciplines of natural science. The present generation of scientists has forgotten that, up to the year 1840 the propagation of our own species was so little known that you could find in medical standard text-books the spermatozoon under the name cercaria, described as an intestinal worm. Count Suminski recognized without difficulty in the globular body in the excavation of the prothallus a female organ; in the moving bodies of the marginal cells the fecundating principle, strangely analogous in shape and movement to the spermatozoon of the animal. Suminski, after having studied alternation between spore-bearing fronds and sexual prothallus, one being the regular offspring of the other, had even a vague idea of an analogy between this alternation and the Generationswechel—in fact, between his discovery and Steenstrupp's.

We know now that he was perfectly right; not so the contemporaneous scientists. Suminski's discovery had to be verified several times. It had to be confirmed by observations of the sexual prothallus of other cryptogams and by Hofmeister's unexpected discovery of the reverted dimorphism of the mosses, in the year 1854. The light that broke into the chaos of detached, isolated facts came too suddenly; it dazzled the eyes of the student; he was afraid, in following the radiant rays of a new truth, to lose from under his feet the old trusty road, and then we are always slow to acknowledge a discovery that we have not made ourselves.

Horkel's and Schleiden's discovery of the pollen-tubes growing into the ovula, had shared the same fate, and after all was much more easily to be controlled and verified than the complicated phenomena of the dimorphism.

There was another difficulty in the beginning. The very pollen-tubes mentioned, before botanists were so much accustomed to the pollen and its grains and tubes as a fecundating principle, that it appeared to them quite preposterous to recognize in an arrangement so different from that of the higher plants, and so similar to that of animals, a regular fecundating process. They forgot that the more we descend to the lower grades of evolution, the more we find plant and animal approaching each other, and that after all, the difference between the movement of a pollen-tube by growing is not so different from the apparently voluntary movement of the spermatozoid.

It would be out of place to enumerate here the different facts gradually collected for the erection of the new system. We will only have to look at the outlines as far as they are well established.

We omit here those lowest methods of propagation in the bacteria, diatoma, etc., also the multiplication by bursting of cells that spread their contents. We mention the conjugata as the first instance of the process of propagation requiring more than one individual. Still the two cells of the alga conjugating are without sexual antagonism.

But with the sexual antagonism appears the dimorphism—first irregular and dependant in its phases, from external circumstances, as in many of the fungi; afterwards regularly alternating according to innate necessity, as in the mosses and ferns. The mosses are the first vegetables that show a regular alternation of a sexual and spore-bearing generation.

Like the fungi that bear their sexual organs and the permanent mycelium and the spores on the transitory stroma, the mosses have their sexual organs on the permanent moss and develop the spores in the transitory theca.

With the development of the vescular system begins a reverted order of dimorphism, that of the ferns, the discovery of whose sexual prothallus by Count Suminski, we have demonstrated in the beginning. Here the permanent frond bears the spores, the transitory, evanescent prothallus, spermatozoid and oösphere.

The prothallus of many ferns develops spermatozoid and oösphere; other ferns develop prothalli of two kinds, some carrying an oösphere, others developing spermatozoides. In some clubmosses and the rhizocarps two kinds of spores are formed: Macrospores, developing almost immediately the spermatozoides, and macrospores growing into a prothallus including the oösphere.

The arrangement approaches near enough the propagation of phanerogamic plants. The microspore is replaced by the anther, the spermatozoid by the pollen-tube, the oösphere by the ovum, and the prothallus itself leaves its traces in the albumen that in many families of plants surrounds and nourishes the embryo.

So you see that there exists no essential difference between the usual form of propagation and those alternations of generations, and that every seed vessel hides a dimorphism.

Although first noticed and discovered in the animal kingdom, the dimorphism is there much less regularly developed and much less pronounced than in the lower provinces of the vegetable kingdom.

It would lead too far to discuss here the complicated phenomena among the radiata mollusca and lower arthrozoa.

The dimorphism of certain insects, for instance, coccides and aphidians, reminds much of analogous phenomena among the fungi, where a sexual reproduction leads to an abundant formation of spores, like the copulation of the aphidians, to a protracted parthenogenesis.

To a certain extent, the different colorations of vernal and autumnal specimens of butterflies belong here, a peculiarity by which parents and children regularly differ, grand-parents and grand-children regularly resemble each other; and of this form of alternation we even find a trace in our own species, where hereditary disease and malformation is most liable to be reproduced in the third generation.

Trichinæ and Trichinoscopes.

HOWEVER much some persons may seek to belittle the danger arising from the presence of trichinæ, it is a fact which cannot be denied that a number of deaths have been caused by this parasite in this country, and it is also an unfortunate but very obvious truth that our country slaughter houses are so arranged and conducted as to have attained the very highest degree of efficiency as breeders of a pest which has been called by high authority "man's most dangerous enemy." And yet a very little sound knowledge, rigorously applied, would soon enable us to stamp out the trichina and rid the country of it entirely.

Impressed with the importance of the subject, the Secretary of the Treasury caused a very able and elaborate report to be prepared and published on this subject, and several other reports have also been issued under the authority of different States. But from their exhaustive and elaborate character, most of these reports are unfitted for popular instruction, and therefore the editor of this journal some months ago prepared a small pamphlet* in which the life history of the Trichina is given in simple language, and the best methods of detecting and destroying it are pointed out. As the pamphlet is easily obtained, we will not occupy space by going over the ground which it covers, and will merely call attention to a new form of Trichinoscope which has been recently brought out by the Bausch & Lomb Optical Company.

Failure to detect trichinæ when they are present, is generally caused by the use of powers that are too high. A simple lens of one-third of an inch focus gives abundant magnifying power, and when the same power is obtained by means of a well cor-

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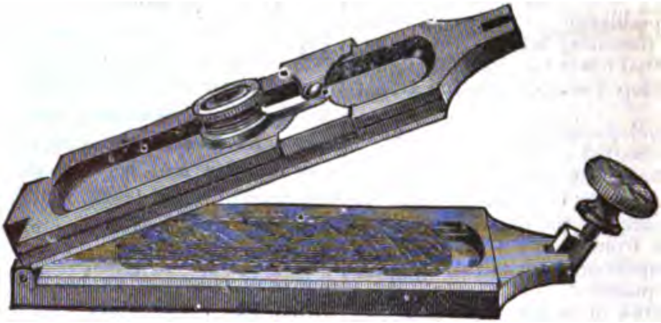
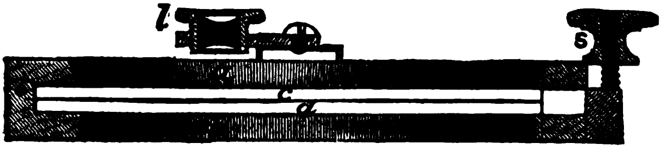
* Trichinæ (Pork Worms or Flesh Worms). How to Detect Them and How to Avoid Them. Being a Popular Account of their Habits, Modes of Propagation and Means of Dissemination. Intended for the Use of Farmers, Butchers, Pork Dealers, and Consumers of Pork. By John Phin, Editor of the AMERICAN JOURNAL OF MICROSCOPY. (This pamphlet may be obtained free by application to the Bausch & Lomb Optical Company, Rochester, N. Y.)



TRICHINOSCOPE. Fig. 1.



TRICHINOSCOPE. Fig. 2.

TRICHINOSCOPE. Fig. 3.

rected doublet, the mere detection of the trichinæ (we do not, of course, speak of their examination) is easy enough. In addition to the use of too high powers, however, inexperienced persons find great difficulty in so *preparing* the flesh to be tested as to render it easily examined. After considerable investigation it has been found that the simplest method is to take a very thin slice, cut off by means of a razor or a pair of curved scissors, and compress it strongly between two plates of glass. In the instrument shown in the engravings we have two metal plates hinged together at one end, and so arranged that they may be powerfully forced together by means of the screw at the other end. In the section, Fig. 2, *a* and *b* are the metal plates, out of the centre of which a large space has been cut, so as to permit the observer to look through the glass plates, *c* and *d*. The screw, *s*, serves to force the plates together, and the microscope, *l*, may be moved from end to end and also across the plates, so as to command a view of every part. The microscope is adjusted for focus by being screwed up or down in the socket at the end of the arm which carries it.

The method of using the instrument is very simple. A thin slice of flesh, having been moistened with a mixture of equal parts of acetic acid and glycerine, is placed on the lower plate and spread by means of needles, fixed in wooden handles, or by means of a camel-hair pencil or brush. The upper plate is then brought down upon the lower one, and the screw is turned into the slot in which it fits. By turning the nut, *s*, Fig. 2, any degree of pressure may be brought to bear on the flesh, which may thus be rendered so thin and transparent that any trichinæ present will be readily visible, when the trichinoscope is held up between the eye and the light, as shown in Fig. 3.

But while it is very desirable that the trichina should be utterly destroyed, and its propagation prevented, those who relish the flesh of the pig, in any form, need not be deterred from eating it by fear of the presence of parasites, for we have, fortunately, in the simple process of *thorough* cooking, a perfectly efficient means of killing all such dangerous guests. But in order to be effectual the cooking must be *thorough;* no mere surface scorching on the one hand, or brief dipping in boiling water on the other. It has long been known that a lump of flesh, placed in boiling water, may be very thoroughly cooked on the outside, while the interior has not reached a temperature high enough to destroy any parasites that may be present. Therefore, whenever animal food is used, see that it is not only cooked, but *thoroughly* cooked.

An Omitted Acknowledgement.

In the description of Mr. Tolles' Thin Mechanical Stage, given in our August number, figures 1 and 2, with the accompanying description, ought to have been credited to the *Journal of the Royal Microscopical Society*. The credit was inadvertently omitted, and the omission was not observed until it was too late to rectify it.

MICROMETRIC RESEARCHES ON CONTRACTED MUSCLE.—In a memoir recently published in Pflüger's *Archiv*, M. Engelmann gives the results of his investigations on the relative thickness of the isotropal and anisotropal layers of muscular tissue in the contracted and in the uncontracted state. He selects the muscles of insects, and fixes them in different grades of contraction by the action of alcohol, osmic or salicylic acids. He finds that in contraction the volume of the isotropal layer diminishes, whilst the anisotropal augments continuously. When at rest the thickness of the isotropal layer is to the anisotropal as 5 to 4, but in contraction the anisotropal layer becomes twice as great as the isotropal, and the increase appears to correspond to the degree of shortening. Engelmann regards the essence of muscular contraction to consist in a process of imbibition, in which the so-called "secondary" or "accessory discs" give up the water which is requisite for the swelling of the anisotropal discs.—*London Lancet.*

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Death of Charles A. Spencer.

MICROSCOPISTS everywhere will regret to learn that Charles A. Spencer, the man who made American objectives famous all over the world, died at Geneva, N. Y., on the 28th of September, at the age of seventy-eight. We have prepared a biography of Mr. Spencer, which is deferred until a portrait of him, now in the engraver's hands, is ready for publication. Mr. Spencer deserves the best memorial which the microscopists of this country can give him. We shall endeavor to do our part by giving as full an account of what he has done as we possibly can.

◆

Leidy's Work on Rhizopods.

IN response to a number of inquiries in regard to this work, we would say that the present market price of the book is $4.00. Not being issued as a business undertaking, but merely printed and distributed by Government, it has no fixed price. Instead of being distributed as it ought to have been to our public libraries and to those students who are specially interested in this subject, Members of Congress sold their quota to the dealers in old books, from whom it must now be purchased by those who want it, and who, in this city at least, offer it freely at the price we have named. If any of our subscribers wish a copy, we will see that one is properly packed and delivered to the express company, our charge for which service will be fifty cents.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Canandaigua Microscopical Society.—The Society met Sept. 13th, 1881, at the residence of Mr. F. F. Thompson. In the absence of the president and vice-president the meeting was called to order shortly after 8 o'clock by the secretary, and Mr. Backus was made president *pro tem.* The minutes of the last meeting were read and approved.

The regular paper for the evening was given by Mr. Thompson, who chose for his subject "Light in Dark Places." This proved to be not a paper but an informal explanation and illustration of the different apparatus in use for illuminating objects for observation under the microscope.

Mr. Thompson chose the "Investigator" stand to work with, and a simple object, the wing of a gnat, to illuminate in as many ways as possible. The methods illustrated were as follows:

1st. With common illumination from diffused light.

2d. With light from a bull's eye condenser.

3d. By light reflected from the mirror swung above the stage, there being no perceptible difference in effect between this method and the one preceding.

4th. By light reflected from a parabolic mirror. This gave a light perhaps a little more intense than the preceding, but not essentially better.

5th. By light transmitted through an Amici prism, which is a prism with one plane and two convex sides. This was found to be difficult to arrange, and of no great advantage.

6th. By light from below from a parabolic illuminator. This gives a beautiful effect and is of great value for certain objects.

7th. By ordinary light reflected from the mirror below and transmitted through the object. The error of using too intense a light, committed by many was exposed. By so doing the fine lines of an object are often obscured.

The subject of the illumination of high powers was passed over and the attention of the audience was directed to the camera lucida, a simple arrangement by which the image of the magnified object is thrown upon a piece of paper where it can be traced with a pencil.

By means of a strong artificial light the image highly magnified was thrown upon a ground glass plate, and by means of the camera obscura the image was photographed. The light used to accomplish this was from a kerosene lamp of great power attached to a magic lantern. The sensitive plate was made of gelatine and nitrate of silver. This being exposed to the light in the camera for one minute, was afterwards placed in a solution of oxalate of potash and sulphate of iron, and washed in a solution of hyposulphite of soda. The resulting photograph of the gnat's wing was highly satisfactory.

It was next demonstrated that this same microscope could rapidly be used as a solar or oxy-hydrogen microscope. By means of the oxy-hydrogen light the greatly enlarged image of the gnat's wing was thrown upon a screen several feet distant. This beautiful exhibition concluded Mr. Thompson's remarks.

Under the head of miscellaneous business it was unanimously voted that the secretary be authorized to enter upon the minutes the deep sorrow that fills all hearts, at the loss by death since our last meeting, of an honorary member of this society, Mr. Francis J. Castle.

The Rev. Mr. Lee was appointed to read the next paper, and upon invitation the society adjourned till the second Tuesday in October, to meet at the residence of Mr. S. D. Bachus.

John H. Jewett, Secretary.

Central New York Microscopical Club.—On Tuesday evening, Sept. 27th, the first meeting of this organization after the summer vacation occurred. President Collins presided, and a goodly number of members were present. After the transaction of the usual routine business, Dr. A. Clifford Mercer read a paper, illustrated by blackboard diagrams, explaining Prof. Abbe's theory of angular aperture. The Secretary then read a paper on preservative fluids, after which Dr. Chas. R. Lee exhibited some slides illustrating the minute anatomy of the human lung when in health, and again, when in a diseased condition.

An adjournment was then had for one month.

Buffalo Microscopical Club.—The regular meeting took place Oct. 11th, at their rooms in the Central School Building. President Henry J. Mills in the chair. There was a full attendance of members and invited guests. The Secretary read the minutes of previous meeting and remarked that he very much regretted the imperfect report of the last meeting of the Club which had by accident been forwarded to the Journal of Microscopy; said report was one that had appeared in one of the local newspapers for which it was reported, and was not exactly a proper representation of the transactions of the club for publication in a technical journal.

Dr. W. B. Walker, of Forrestville, was elected to membership with Dr. J. R. Lansdowne and W. H. Heath of Buffalo.

A paper was read by D. S. Kellicott, Ph. D., on "Pond Life." The paper was mainly a series of notes on forms observed during the month of July last, while rusticating in Central Michigan, and will be found in full elsewhere. Many of the form were exhibited, and all were described with the aid of blackboard drawings, in a most interesting and thorough manner.

Remarks were made by the members discussing the variously interesting points, and thanking Mr. Kellicott for calling attention to the matter which was in the path of every member, open to investigation during his leisure time, and which was, as in this case, of much interest to all microscopists as indicating that regular and thorough work with the microscope was being steadily pursued with energy.

The president presented as a record of personal work, a short paper (printed elsewhere) on the statoblasts of a local sponge. Prof. Kellicott also read a brief note on the species of polyzoa thus far observed in the vicinity of Buffalo. They were as follows: Paludicella Ehrenbergii, Fredericella regina, Plumatella diffusa, Plumatella arethusa, Plumatella vitrea, Pectinatella magnifica, Cristatella ophidiodea.

Mr. Geo. E. Fell exhibited a slide of Volvox Globator, a glycerine mount, prepared several years ago and still well preserved; also sections of the umbilical cord showing well its structure.

Mr. Mills exhibited sections of the sponge statoblasts, illustrating the points claimed in his paper.

Dr. Walker presented some specimens of the Bedeguar of the rose, and remarked upon their abundance, also upon a parasite probably hymenopterous, destroying the same.

Dr. Geo. E. Blackham, F. R. M. S., president of the American Society of Microscopists, present by invitation, spoke of the affairs of that society. He gave a brief résumé of the measures he had undertaken for the next meeting at Elmira, Aug. 17, 1882, and said that the promises of attendance and papers was most satisfactory and encouraging. He entreated the Club for earnest and enthusiastic work for that meeting. The Buffalo Club proposed to respond. Mr. E. H. Griffith, member of the executive committee American Society of Microscopists was present and spoke concerning the Society. He referred particularly to the activity of microscopical societies in different places, and to the encouraging fact that they all propose to send large delegations to Elmira. He also exhibited to the Club the perfected Griffith microscope, which was commented upon very favorably by the members.

A committee was appointed to prepare a suitable memorial in reference to the death of the late Chas. A. Spencer, of Geneva. They report for record the following minutes and resolutions:

This Club has heard with sincere sorrow and regret, of the recent death of Charles A. Spencer, of Geneva; a man of integrity and uncommon inventive skill, whose name is engraved upon some of the most most useful microscope lenses that optical ingenuity has contributed to microscopical science. Recognizing Mr. Spencer's well earned reputation as an optician of acknowledged originality and ability, and having experienced the pleasure and advantage of his personal acquaintance, as well as his professional aid in the work in which this Club is especially engaged; we therefore enter of record the following resolutions:

Resolved, That we contribute our testimony of respect and sorrow to the memory of Charles A. Spencer, whose earthly work is over, but whose many services to microscopical science will be long remembered and honored, where ever the microscope is used as an instrument of research.

Resolved, That we fully appreciate the serious loss that all workers in the field of microscopical research will feel that they have suffered by his unlooked for removal.

Resolved, That we sincerely sympathize with the afflicted family of our deceased friend, in their bereavement, and that we transmit to them a certified copy of this memorial.

Jas. W. Ward,
Henry Mills,
Geo. E. Fell,
Committee.

The above copy is a correct transcript of the original memorial entered in the records of the Buffalo Microscopical Club.

Lee H. Smith, Sec'y.

State Microscopical Society of Illinois.—The first meeting of this society for the present season was held at the rooms of the society, in the Academy of Sciences, Friday evening, Oct. 14th. The president, Dr. Lester Curtis, in the chair.

After the transaction of routine business, Mr. Stuart described the microscopical structure of some vegetable drugs. The subject is not suitable for abstraction, and requires illustrations to be useful.

His paper was followed by one by Dr. Curtis, describing a new stand made for him by Bulloch. This stand presented some novel features, among the most striking was a mechanical stage of extreme thinness, admitting light at an angle of 160°. The movements were effected by a double pinion above the stage, an arrangement pronounced by those familiar with the operation of the contrivance, as exceedingly useful and convenient.

The stand excited considerable interest, as did also a right angled camera lucida of German manufacture which was adapted to it. The superiority of which over the ordinary form was so marked as to be unmistakable on trying it, even under the disadvantages of a crowded room and constant jar. After a discussion of the papers the meeting adjourned.

E. B. Stuart, Secretary, *pro tem.*

Wellesley College Microscopical Society.—The October meeting of the Wellesley College Microscopical Society was held Oct. 26th. The president, Miss S. F. Whitney, in the chair. The time of the meeting was chiefly occupied by Miss Whitney with a brief tribute to the memory of Mr. H. F. Durant, the founder of the College, who, although his name never appeared in connection with the society, was largely instrumental in its organization, and had ever been its most enthusiastic and generous supporter, sparing neither pains nor expense in his efforts to further the interests of the Society.

Some thirty slides were exhibited under the lantern, and a number of rare and beautiful objects under the microscope.

Lucia F. Clarke, Cor. Sec'y.

The New Jersey State Microscopical Society.—The first Fall meeting was held Oct. 17th, in the Geological Hall of Rutgers' College, New Brunswick. There was a grand attendance, and some important routine work was done. The finest original slide shown was one of arranged diatoms by Mr. C. H. Kain, prepared with his mechanical finger, as figured and described in the American Journal of Microscopy for August. The evening was chiefly taken up with a novel paper on the laws and phenomena of optical phosphorescence, illustrated by objects painted with Devoe's "Balmarine Luminous Paint." The paper was in fact an exposition of this interesting novelty. A hearty vote of thanks was tendered the gentleman for his paper, and the Society adjourned.

EXCHANGES.

Sole skin and fossil wood (showing fern structure) from Iowa coal, for other good material or mounted objects. John Walker, Minneapolis, Minn.

A Ballard breech-loading rifle, in good condition, for a good spectroscope. D. L. H., Box 58, Kingsville, Ohio.

A small 3 draw telescope with sun-glass, made by Dolland, London, for a 1-16th objective of moderate angle, by any first-class maker. Dr. Mercer, 37 Twenty-sixth St., Chicago.

Wanted, a small microscope stand or accessories, for an Amer. Optical Co. 8 x 10 double-swing back camera, very suitable for micro-photography. Has been used a few times only. F. F. Stanley, Swampscott, Mass.

Living Volvox Globator, in any quantity, for mounted algæ or other slides. St. Lawrence River or Northern New York algæ: desmids and diatoms for same, in other places. J. M. Adams, Watertown, N. Y.

Birds' eggs and whole insects in exchange for mounted objects of any kind, in good condition and well mounted. W. J. M., Box 201, Moorestown, N. J.

Fine fern-leaf copper crystals, arranged, and named diatoms; fine histological and pathological specimens; sections of teeth—the latter on the ground-glass slides, used at Geological Hall, Albany, N. Y. The above are all nicely mounted, and only first-class slides are required in exchange. Dr. Robt. Dayton, 559 Euclid Ave., Cleveland, O.

Will exchange mineral specimens of Idaho (for cabinet or microscopic use) for well-bound books of an instructive nature. Send list of books with particulars. John Chorette, Junction, Lembi Co., Idaho.

Chara in fruit fully ripe, structure of sporangia, antheridia and antherozooids, easily shown, for the asking. W. W. Munson, Otisco, Onondaga Co., N. Y.

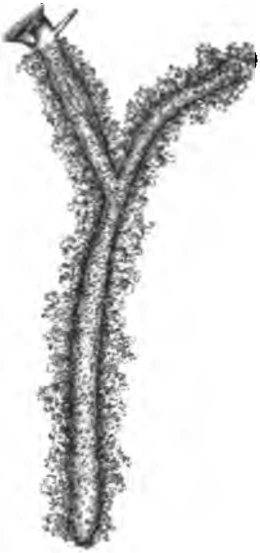


Fig. 1.

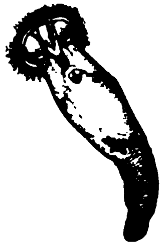
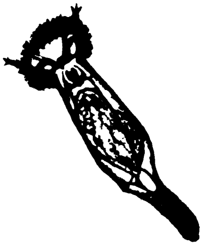


Fig. 2.



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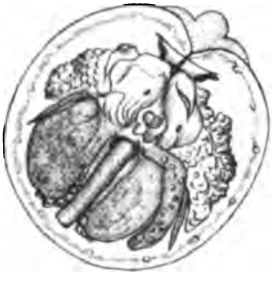

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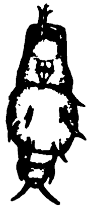

Fig. 5.

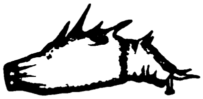

Fig. 6.

Figures illustrating
Leaves from a Summer Note Book.

THE AMERICAN
Journal of Microscopy,
AND
POPULAR SCIENCE.

VOL. VI. NEW YORK, OCTOBER, 1881. No. 10.

Leaves From a Summer Note-Book.

BY ALFRED C. STOKES, M.D.

I.

Clathrulina Elegans.

WRITING of the development of this beautiful rhizopod, Dr. Leidy says: "From the observations of Cienkowski on the mode of reproduction of Clathrulina, it multiplies by division. According to him the Actinophrys-like body within the latticed capsule undergoes constriction and divides into two. After a time the pair of animals withdraw their pseudopodal rays, and then appear as simple granular spheres. These pass out of the latticed capsule, and assume the appearance of the common Sun-animalcule, which subsequently develops a stem of attachment, and finally a latticed capsule enveloping the sarcode head. Sometimes the original Actinophrys-like body divides into four, and at times assumes the smooth, spherical form without division."

This mode of reproduction I have not seen. I have, however, witnessed two other methods, one explaining the formation of the colonies, the other showing how the individuals are scattered over a large space.

The specimen with which the first method was observed had, when found, already undergone division into two spherical masses, each emitting pseudopods, and having a lateral contractile vesicle, with the nucleus represented by a sub-central spot of light. The lower of the two animals, by the withdrawal of its rays, soon became a smooth globe of sarcode, and immediately began to pour out of one of the openings in the latticed shell. During the process the contractile vesicle was conspicuous, but upon its completion was not visible. Before the mass of protoplasm had entirely escaped, there appeared two anterior flagella of unequal length, the shorter being vibratile, the longer terminating in a bulbous expansion within the parent shell. The macrospore is thus never quite independent of the latticed capsule to which it is at last to be permanently attached. The object of this arrangement is evidently to prevent the escape of the flagellum during the animal's movements, and thus to keep it within a reasonable distance of the foundation upon which the foot-stalk is to be built.

The newly-formed animal was, to all appearance, a bi-flagellate infusorian anchored by its trailing flagellum, the ovoid body being delicately granular, containing partially digested food particles taken during a former phase of existence, and with the posterior extremity sharply acuminate. In length it equalled, if it did not exceed, the diameter of the parent shell. Its motions were oscillating and rotatory, and not rapid. They continued for perhaps five minutes, the bulbous anchor freely slipping from side to side of the lattice opening.

Gradually the motion became slower, and gradually the ovoid body became rounded; irregular expansions of the surface appeared, a ray shot out followed by another, and another, until the bi-flagellate animalcule had become an *Actinophrys sol* anchored to a Clathrulina shell, and with a flagellum quivering at its front. This anterior lash remained visible for several minutes, when it finally disappeared among the pseudopods—whether absorbed, or thickened into a ray, I could not determine, but until it was gone the animal was motionless, the posterior flagellum being unchanged. The latter, just before the transformation into the Actinophrys-like body, had been curved by the animal's movements, and it seemed to have stiffened, so that the organism was now held near the parent, and suspended in the water at the end of what I supposed would develop into the pedicle of the new shell. But the conclusion was premature, for this attachment was temporary only, and seemed to serve the one purpose of preventing the germ from wandering so far from its future basal support that the formation of the permanent stem would consume too much of its substance or of its vitality.

After a few moment's rest a thick pseudopod was formed and attached by an expanded base to the lattice, and by an imperceptible addition of material from the supported animal, it gradually lengthened until the Actinophrys, with all its pseudopods rigid and unchanged, as they had been from the first, was finally lifted to the proper distance from the parent, and it only remained for the new Clathrulina to secrete its latticed shell. As the pedicle lengthened, the anchoring flagellum became more and more attenuated until it was at last lost to sight. My impression is that it was united with a pseudopod, probably with the pedicle, and thus returned whence it had come. The animal then assumed a spherical form and, after a short rest, surrounded itself with fine rays and began the secretion of the shell. As the proper objective for the study of this process was not at hand, I was unable to determine whether the pseudopodal rays played an active part in this connection, or whether the body alone was concerned. I think, however, that the rays are a more important factor than might be supposed. From the imperfect glimpse I could obtain, the action of the body-mass seemed of but secondary consequence.

The second method of reproduction which I have witnessed, that by which the species is disseminated, is accomplished by a somewhat similar process. The sarcode of the original animal divides by transverse fission, the process consuming about three hours. The resultant macrospore closely resembles that described above, both in form and size, and in the possession of two anterior flagella, the latter, however, of apparently equal length. It exudes slowly through the parent lattice, and at once becomes an ovoid, bi-flagellate infusorian, the only conspicuous differences between it and the colony macrospore being in its perfect freedom and the absence of the contractile vesicle. Its motion was moderately active and continued for less than two minutes. when, without a moment's warning, it reared up on the flagelliferous end of the egg-shaped body, and before the focus could be changed collapsed into a shapeless drop of protoplasm, bearing a multitude of short blunt pseudopods at once becoming filiform, and Clathrulina was again a Sun-animalcule, and proceeded to secrete the pedicle and the shell.

This Actinophrys form of Clathrulina has an enemy in the common Turbellarian worms. An individual was swallowed in my presence, a sad event which I have not seen to occur to the true Sun-animalcule.

As a memento it left on the glass a refractive little mound of protoplasm, the remains of the budding stem.

II.

Actinurus—(n. sp.?)

A growth, apparently of Algæ, upon the side of a bottle containing pond-water, attracted my attention by its quivering motion when the vessel was turned. An examination showed an abundance, and when once noticed, the objects became conspicuous. Varying from one-eighth to one-half an inch in length, the smaller filaments single, sigmoid or variously curved, the larger with two, three, or even four branches, they proved to be so delicate that it was hardly possible to remove a specimen with the dipping-tube without a fracture. Like most microscopical objects it was a surprise when put under the lens, although the microscopist soon learns to take matters as they come, and with a feeling of satisfaction rather than of wonderment. Yet here was a strange thing.

Other rotifers have been seen in a protecting case—*Limnias* inhabits a membranous sheath, *Melicerta* builds its home of vegetable bricks, *Floscularia* and *Stephanoceros* each spreads its arms from the entrance to a crystalline dwelling-place—but here was a creature, a rotifer, clinging with the tips of its toes to the side of a gelatinous tube which falls to pieces at a touch, shrinking into the frail covering at every jar, and holding it by a tenure so slight that when the water becomes uncomfortably deoxygenated, the tips of the toes are withdrawn, the ciliary discs are spread, and the creature is off to "fresh fields and pastures new." All of this does my curious wheel-bearer, and more.

The jelly-like tube seen in optical section, Fig. 1, has considerable thickness, and is irregularly surrounded by granular matter arranged in a most uncertain fashion, and with a consistency about equal to that of the sheath itself. From the free end the rotifer projects and builds with remarkable rapidity. And at intervals, as the tube lengthens, she leaves the old foothold, and advances one step, so that she always lives in the top story, and the basement is always empty.

At first sight I supposed this tube to be formed of the animal's excreta and of extraneous matters accidentally adherent, and I still imagine that both are used in the building, but with the addition of indigo to the water, the secret was out. It is formed of floating particles which the rotifer has the power to cement together and voluntarily arrange; the color, therefore, must vary with the tint of the building material. The process is as follows:

The indigo rendered very distinct two currents setting in toward the median line, carrying the particles down between the ciliary discs and throwing them outward in a strong stream from the depression separating the lobes in front. The result shows that this current must take with it a tenacious mucus, secreted for the purpose, since the grains of indigo immediately adhered, and in less than half a minute formed an irregular blue semicircle at the top of the old tube; even the particles which were swept away had a tendency to cling together, and, as they floated in irregular clusters out of the stream, fell to the sides and adhered, making that uncertain, flocculent deposit surrounding the tube. This current of building material the rotifer can direct at will, so that by bending the body from side to side and by a change of position, the sheath is completed and kept pretty nearly level. With an individual which had abandoned her old tube and just started another, a downward current over the whole body surface was noticed carrying the smallest of the indigo particles, and so large an amount of mucus that it coagulated in shreds and strips between the body and the glass. What produced this current could not be determined. A blue ring had encircled the animal anteriorly, and it seems probable that this surface flow was to prepare the lower and intermediate parts of the sheath. Such, at least, was its effect, as, after an enforced absence, I found the rotifer ensconced within an opaque tube formed entirely of indigo.

It is likely that not only the color, but the strength of the building depends upon the character and abundance of the material used. The water in the present instance was at first clouded by suspended matter, but since it has cleared, I notice that the tubes formed at the bottom of the bottle are firmer and darker than those adherent to the sides nearer the top.

In general appearance the animal resembles *Rotifer vulgaris*, and when out of the tube has similar actions. The young, however, escape from the egg within the body of the parent and are born alive. In a few instances I have seen two individuals occupying the same tube. They were probably mother and daughter, with the arrangement only temporary, and preparatory to the building, by the daughter, of an addition to the house. I suppose each member is a descendant of the original founder of the colony. The following may be taken as its description:

Actinurus—(n. sp.?) The elongated body, fusiform; ciliary lobes, two; eye-spots, two, on the proboscis; jaws, two, each with two parallel teeth; tail, bifid; foot, trifid, retractile, with telescopic joints, middle toe longest. Inhabiting the extremity of a soft, flexible, tubular sheath, varying in length, and branching to form social colonies, from which the animal can depart at pleasure, being temporarily attached to one side by the tips of the toes only. Length, when extended, about 15-1,000th of an inch. Ovo-viviparous.

The literature of the Rotatoria at my command is limited to the possession of the second edition of the Micrographic Dictionary. The scattered condition of the literature of most microscopical subjects is the country student's greatest obstacle. I can therefore only refer the present species to its genus. According to the classification of the work just referred to, the rotifer's two ciliary discs and the absence of carapace, place it in the family *Philodinœa*, whence the two frontal eyes, bifid tail and three toes relegate it to the genus *Actinurus*, of which, the Dictionary says, there is but one species. If that statement is correct, then is this new.

III.

Body, clavate; ciliary disc, continuous, transverse; eye-spots, none; jaws, two; tail-like foot, cylindrical, truncate, terminated by a small suctorial disc, much wrinkled circularly and presenting an articulate appearance; anal aperture, dorsal; body bearing an anterior, external, cervical process which is two parted, each division furcate and having a short supplemental spur projecting obliquely inward, upward and forward, the whole slightly curved toward the ventral aspect.

When the creature shown in Fig. 2 first came within my angle of vision it was not fully expanded, and the conclusion "borne in upon my consciousness" was that the conspicuous ornament which it carries anteriorly was a new kind of caudal appendage. I suppose every observer frequently feels inclined to smile at the grotesque shapes and antics of some of his captives from the ponds, but here the lowly animal had the best of the joke; when she spread her rotatory disc the laugh might well have been at the other end of the tube. The little creature has neither calcar nor proboscis, but, as a substitute, an inflexible process of an interesting and suggestive form.

The anal aperture is dorsal and never entirely invisible, as there appears to be an external projecting membrane surrounding the opening through which the rectum is at times protruded. This somewhat unusual position probably prevents the classification of the animal with *Ptygura*, which genus it most nearly approaches, as the Micrographic Dictionary states under that division, among the generic characters, that the "anus is situated at the end of the tail-like foot." I am, however, inclined to believe that the present specimen is a member of the genus.

IV.

Body, clavate; rotatory disc, continuous, transverse; eye-spots, none; jaws, two; tail-like foot, cylindrical, terminated by a suctorial expansion; anal aperture, ventro-lateral; body bearing two dorso-lateral, cervical calcares; inhabiting, without permanent attachment, a granular, gelatinous tube of its own construction.

This rotifer, taken in water with a gathering of algæ, is represented in Fig 3. In general appearance it resembles the preceding, and its proper position as regards its classification would be near *Ptygura*, if the habit of forming a protective sheath of foreign bodies cemented together by its own mucus, the presence of the two calcares or antennæ, and the ventral anal aperture would not make a resting-place in that genus inadmissible.

The tubular sheath is short, unbranched and delicate. Its formation I have not witnessed.

The most remarkable, indeed the characteristic, feature of its structure, is the two long calcares projecting laterally from the cervical region immediately behind the ciliary disc. Unlike the corresponding single organ with the Rotatoria in general, they are not carried out of sight when the anterior part of the animal is introverted, but remain exposed whatever may be their owner's position.

The anal aperture is ordinarily inconspicuous.

The wrinkled, tail-like foot is terminated by a suctorial disc, by which the animal is anchored to the side of the tube. It occasionally adheres firmly to the slide when the rotatory organs are expanded, and even when contracted I have tried in vain to dislodge it. The tendency is to swim backward, or to revolve, with the suctorial disc for a pivot.

V.

Pterodina.

Carapace hyaline, orbicular; in anterior transverse section, slightly double convex; dorsal surface roughened near the margin by minute elevations often so arranged as to leave a row of circular, smooth spots; the orbicular outline is interrupted by an anterior dorsal projection with a central lip; rotatory discs, two; eye-spots, two, frontal; jaws, two; teeth numerous; tail-like foot, cylindrical, retractile within the carapace, and terminated by a ring of cilia. Diameter, about 7-1000th of an inch.

The form shown, partly retracted, in Fig. 4, I have seen this Summer for the first time, although it seems to exist in some abundance among the leaflets of *Ceratophyllum*. It is remarkable for its outline and its perfect, crystalline transparency; and a fact worthy of note is its habit of drawing the tail entirely within the carapace, which it appears to do with pleasure, if frequency is a criterion. The action always called to mind Coleridge's poem, "The Devil's Thoughts," dear to the heart of every school-boy orator, and doubtless familiar to the reader.

It is hardly necessary to say by what authority the specimen is put in the genus *Pterodina*. Under this heading the Dictionary describes one species, saying, there are three, "two aquatic, one marine," and from the former mentions *P. patina*, which this is not. It may, however, be the second fresh-water form. Its muscles are striated.

VI.

Philodina—(n. sp.?)

Rotatory discs, two; point of calcar apparently three-lobed; eye-spots, two, cervical; jaws, two, roughened by numerous small transverse ridges, and with three large and prominent teeth; tail, bifid, the parts widely divergent; foot, trifid; the hardened integument of the body roughened by minute elevations and bearing twelve spines, of which ten are dorsal and recurved, and two lateral and directed anteriorly. Length, with ciliary lobes expanded, 15-1,000th of an inch, when fully extended, crawling, 18-1,000th.

I have met with but two specimens of this rotifer, once in February last, taking it from beneath the ice, and in September; in both instances from the same locality.

Quoting once more from the much-quoted book, paragraph Philodina: "Ehrenberg describes seven species; they are all aquatic, and in general structure and appearance resemble *Rotifer;*" and of the only spine-bearing species mentioned, *P. aculeata*, "the body is covered with soft setaceous processes," which hardly agrees with the present specimen. The individuals which have come to my notice are represented partially contracted in Figs. 5 and 6, dorsal and side view respectively; they have setæ, which bend only because the general integument is not entirely hard and carapace-like, and the body cannot be said to be covered with spines when there are but twelve.

VII.

Rhipidodendron splendidum (Stein) I have found in this locality in considerable abundance. W. Saville Kent, in his "Manual of the Infusoria," describes "this most remarkable type," as he designates it, but does not seem to have met with it in England. Mr. J. A. Ryder, *American Naturalist*, November, 1880, records it from ponds near Woodbury, this State.

Spongomonas intestinalis (Cienk) also occurs here, sparingly.

Trenton, N. J.

Striæ of the Diatomaceæ.—II.

RETURNING to the assumed identity of the three types last described, no mention has been made in the discussion to which it has given rise of any gathering in which these three types have been found united, unless it is in the deposit of Cherryfield, in America, in which only *Navicula rhomboides* and *N. crassinervis* exist. Also, not being aware up to the present time of any gathering of living diatoms in which the three forms are found united, it seems to me a sufficient argument against admitting for the present their supposed identity. This argument, however, is only negative, and, as there is no proof, the identity remains possible. But there is a positive argument which, if I am not mistaken, refutes that which considers the three forms other than three distinct and autonomous types. If we examine attentively the three diatoms, it will be found that the transverse striation of *Frustulia saxonica* of the Typenplatten of Möller has 3,400 striæ to a millimetre, whilst the longitudinal striæ are 3,600. By the same measure, *Navicula crassinervis* has 1,400 transverse striæ, whilst the longitudinal are not less than 2,400. Who can say now that the three types are only one species? Up to the present time there is no positive reason or experience which can authorize our admitting that a diatom presents such an irregularity in its striation that a frustule has the transverse striæ notably finer than the longitudinal, whilst another frustule of the same species has an entirely opposite arrangement. It is true that there exist species whose striæ are distributed in a singularly irregular manner on the surface of the valve, *Eunotia formica* Ehr., for example, but the distribution of the lines in the three types above referred to shows, on the contrary, an admirable regularity over the whole surface of the valves.

But having condemned, as leading to error, the use of the eye-piece micrometer for counting the striæ, a process to which I have attributed for the most part the divergences in the determination by different observers of the number of the striæ, having then spoken of the number as counted by myself in the transverse and longitudinal directions on three different *Naviculæ*, one of which is the most difficult to resolve of any I know, it may be asked what process I have followed—which is one so exact that I am able to disagree with microscopists of incontestable authority? This question is very proper, and I hasten to reply to it so that every one may judge if I am wrong in relying on the correctness of my figures, and so that the exactness of my process being once recognized, all may profit by it. I use the ordinary process of photo-micrography, and I have made collections of about 3,000 photographs of diatoms under the uniform amplification of 535 diameters. I employ negatives on glass, and with a suitable apparatus I project the photograph of the diatom on the opposite wall of my laboratory enormously enlarged. I then put over it a piece of paper cut so as to represent exactly 1-100th mm. under the same conditions, that is to say, taken from the photo-micrographic image of a millimetre divided into 100 parts and enlarged to 535 diameters. Superposing the paper on the clearest and most regular part of the image, I count or mark each stria or granule, and the number obtained multiplied by 100 gives me the number comprised in a millimetre, either longitudinally, transversely or obliquely, according to circumstances. I do not think it can be denied that this method is a very accurate one; the possible error is hardly worth notice. It is true that the process implies the employment of photography, which, although it can be of great assistance to the naturalist and microscopist, is not yet within reach of every one, nor in habitual use with any. With less convenience, however, one may arrive at the same result by using the camera lucida, or better still, by projecting the diatom directly by means of a good solar microscope.

I have employed this process of measurement to enable me to form a correct opinion on the number of striæ, its constancy or variability in a given species, and to enable me to determine whether it was able to furnish a reliable character in the determination of species. In his "Synopsis of the British Diatomaceæ," vol. ii. p. xxiv. of the introduction, Smith expresses himself thus: "Whether the striæ . . . . are mutually parallel or radiate in their arrangement; reach the median line or are absent from a greater or less portion of the valvular surface—whether the cellules themselves are arranged in squares or disposed in quincunx; and the striæ in their transverse direction are consequently parallel or oblique in reference to the margin or the median line—the relative distances of the striæ and their greater or less distinctness—all these are features which may safely be regarded as of specific importance . . . , though subject to slight modifications arising from the accidents of locality and age, etc." However great this authority may be, I have preferred to rely upon experience, which is in fact the sole supreme judge, and without appeal in such a matter. I think that two forms found in different localities and at different times, however great the affinity which they may present *inter se* in their characters, may form two types closely bordering upon one another, but nevertheless independent and distinct, and destined to produce their own form though an indefinite number of generations. We see this fact happen in many other orders of organisms. Whether these are better called *varieties* than *species* seems to me wholly indifferent, the distinction between the two words depending on the different value which is commonly given to them, a value and signification considerably elastic—provided always that we recognize the permanence of the form in the successive generations; and this exact permanence of form in the smallest peculiarity of structure in the Diatomaceæ is demonstrated as a constant law by my study of those of the carboniferous epoch.

However, when I happened in a certain locality to find a collection, composed of myriads of frustules evidently belonging to a single species, and forming a single family,* I determined at once to make a most attentive examination, feeling assured that in such circumstances only could the most conclusive elements be obtained for recognizing the extent of the possible modification of the typical form. These circumstances are not at all frequent, although they are sometimes found; I therefore recall with regret that in the early times of my studies on the Diatomaceæ, being desirous of obtaining new types, I was vexed at finding gatherings composed of one or two forms only, all which I rejected, not knowing then the profit which I might draw from them. In gatherings of this kind formed of masses of frustules belonging to a single species, we find a series of forms varying in size and presenting sometimes notable variations in outline. But in reviewing the different dimensions and outlines of the frustules, we recognize after attentive examination that amongst these frustules there is a complete gradation, so that in passing from one to the other by insensible degrees we prove the identity of the extreme terms of the series. Moreover, when we see at the same time that the disposition of the striæ on the valves (rows of granules or any peculiarity like nodules) remains perfectly constant and uniform, we recognize that all the frustules of the collection, notwithstanding the differences in size and outline, belong to the same species.

One of the most favorable circumstances for my views was afforded more than twelve years since, when I was permitted (thanks to the courtesy of M. Alphonse de Candolle) to select, from the very rich herbarium of the illustrious botanist of Geneva, some small fragments of Utriculariæ coming from very different localities, and which I found incrusted with diatoms. One of these Utriculariæ came from Rio de Janeiro, another from Java, and a third from Senegal. All three were equally covered with frustules of *Eunotia formica* Ehr. In reference to this fact, I may call attention to the singular peculiarity that the same very rare species of diatom is always found on the same plant, although the latter comes from three very different parts of the globe, a circumstance which may, in my opinion, lead to the conclusion that the Diatomaceæ are not only epiphytes, but parasites. These three different gatherings all showed the characteristic form of *Eunotia formica*, with the angular swelling in the centre, the intermediate constrictions, and all the other characters of nodules and pseudo-nodules and moniliform transverse lines, interrupted by an eccentric hyaline line, and unequally distributed. Moreover, the three gatherings contained numerous frustules of very different size and outline, but all presenting the same peculiarities of structure; thus not leaving the least doubt that they all belonged to the same species, *Eunotia formica*. The longitudinal axis in the largest forms was five times the size of the same axis in the smallest forms, and in the latter no indication of the central swelling could be seen, their aspect being rather linear, or showing a slight constriction. I have before me a series of photographs which I have made, representing the entire series of these different forms: looking at the distance of the striæ (especially in the largest and most characteristic specimens), these being very close at the extremities, wider in the centre, and still wider in the two intermediate constrictions; following the gradual variations of outline and size of the frustules, it is impossible not to see that these represent nothing else than different stages of development, and that in this diatom there is at least a bilateral *auxesis*, and perhaps also a simultaneous dilatation or stretching of the middle parts between the centre and the extremities. The different forms of this diatom have also been seen by A. Grunow, and figured in the paper which he published on the fresh-water Diatomaceæ of the Island of Banka.

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* Produced by a single sporangial frustule.

When we consider the uninterrupted series of *sizes* and *outlines*, all the structural characters remaining at the same time absolutely identical, we are necessarily led to regard all these frustules, although of different dimensions and outline, as belonging to the same species, and representing simply different degrees of organic development. But in this comparison, the character the constancy of which is the most difficult to establish, is the fineness of the striæ which ornament the valves, that is, the number contained in a fraction of a millimetre, so that the invariability of this character in frustules of different sizes belonging to the same species may be verified. It seems to me so much the more necessary to demonstrate this fact in an irrefragible manner, because it is precisely on this point that there is the greatest disagreement in the opinions of those who are regarded as having most authority in the matter, and, moreover, the deductions which may be drawn from it would be of the highest importance to elucidate the biological laws to which the whole family of the Diatomaceæ are subservient. Amongst the observers who are the most able and of the most authority, must be first mentioned Dr. Wallich, whom I have the honor to know personally, but whom, entirely from the love of truth, I am obliged to contradict. At the meeting of the Royal Microscopical Society of London, of the 3rd January, 1877, he read a paper "On the Relations between the Development, Reproduction, and Markings of the Diatomaceæ,"* in which he said that "whilst the *total* number of the striæ on the valves of a diatom may remain nearly uniform in every valve of the same species, the number of striæ on the fractional part of a valve (as a thousandth of an inch) admits of just as much variation as the size of the valve, and proceeds simultaneously with it during division, but not afterwards." This opinion could not be ennunciated more explicitly, but is it in accordance with experience? Let us see. From the results of the microphotographic method above described, I am able to demonstrate to Dr. Wallich that his view is not sound, that he has without doubt been mislead by a preconceived idea, and that he has not verified the fact by personal experience, relying probably too much on the different figures given for the striæ in a particular fraction, by different microscopists who have employed the faulty process of the eye-piece micrometer.†

Every time that by a happy chance I have been able to discover a mass of diatoms all belonging to a single species, mixed with which were frustules of another genus, I have endeavored to profit by the occasion to make an attentive examination, and to ascertain the nature of the deviations from the typical form which constitute the idiosyncrasy of the species. On these occasions, after having recognized the types and sizes of the frustules which differ the most, but which are connected by a continuous series of frustules of intermediate size and form, so that no doubt can exist as to the identity of the species to which they belong, I reproduce, by means of microphotography, the image of the smallest and of the largest frustules, always adopting the amplification of 535 diameters. Projecting successively the two images on the wall, I count the striæ contained in 1-100 mm.; *and up to the present time* I have never found a single case in which the number of the striæ is not constant. In two memoirs which I have published in the "Proceedings" of this Society, one under the title of "Nuovi argomenti a provare che le Diatomee riproduconsi per germi"* ("New Arguments to prove that the Diatomaceæ are reproduced by Germs"), and the other, "Osservazioni e note a elucidazione dello sviluppo delle Diatomee"† ("Observations and Notes to elucidate the Mode of Development of the Diatomaceæ"), I have referred, with details, to two gatherings which I obtained and examined. The first contained only *Pinnularia stauroneiformis* Sm. var. *latialis*, the other only innumerable frustules of *Cyclotella pisciculus* Ehr.; the largest and the smallest valves of the two species compared together gave an identical fineness of the striæ. I have made this year. and with the same result, similar examinations of different species of diatoms from the first Century of the typical preparations of Dr. Eulenstein, particularly *Navicula Jennerii* Sm. (*Scoliopleura tumida*), *Navicula* (*Pinnularia*) *major* Kz., *Isthmia enervis* Ehr., and *Navicula didyma* Kz., on a preparation by Bourgogne. After results so concordant, it does not seem to me possible to doubt that, at least in these species, the fineness of the striæ is the same on valves of different dimensions, that is to say, that the fineness of the striæ is determined by the idiosyncrasy itself of the species, and consequently that, in accordance with Smith's opinion, the striæ and their fineness are *a quality of specific importance.*

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* Mon. Micr. Journ., xvii. (1877) p. 61.

† Dr. Schumann, in "Die Diatomeen der Hohen Tatra," says that the structure of the frustule and closeness of the striæ depend on the elevation above sea-level. The higher the habitat the smaller the frustule and the closer the striæ. Mon. Micr. Journ., xiii. (1875) p. 265.

Finally, to better convince those who have a contrary opinion, and to prove that the number of the striæ remains constant in large or small diatoms, provided that they belong to the same species, and that consequently we cannot refuse to the number of these striæ the value of a specific character, I will refer to the fact that in the above-mentioned Century there is a very fine preparation of *Isthmia enervis* Ehr., *in situ*, on which the frustules adhere to one another by the angles and are attached to the pedicel. The same pedicel bears large and small frustules united together. so that no more favorable occasion could have been found to test the matter. I then produced, with the usual amplification, the frustules of extreme dimensions, and measured the lines of small granules on the bands or zones on the one and on the other, and I did not find the least difference in the numbers. I think. therefore, that it is not possible reasonably to maintain the least doubt. If, however, any observer prefers to rely on his own verification, nothing would be more agreeable to me, for I shall then see my assertions confirmed independently.

In speaking above of *Eunotia formica* Ehr., I have referred to the characteristic peculiarity of this very interesting species, that is, that the moniliform striæ are distributed in an irregular manner and are peculiarly grouped and close at the two extremities and wide in the intermediate parts. By this observation I have shown that I do not consider the character of the striæ and their number as a character of an absolute specific value, but that I admitted this value only when the distribution of the striæ on the surface of the valve is regular, a condition which is presented in most cases, as in the *Naviculæ*, the *Synedræ*, and many others. But there is still another consideration which I wish to put forward to better explain my views. In the greatest number of different types of Diatomaceæ which I have reproduced and measured by microphotography, I ought to admit that in examining certain species, although well-determined but placed in different preparations, I have found some differences in specimens of the same species, in regard to the number and fineness of the striæ; nevertheless, when I have met with these differences, they have never been considerable relatively and proportionally to their number, for the difference has never exceeded 1-5. But at the same time I declare most emphatically that up to the present time I have never found the smallest difference when I have compared the frustules which not simply belonged to the same species but also to the same stock.

(To be continued.)

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The Waters of Paris.

IN 1850, Mr. Hassal*, at the request of the inhabitants of London, examined the degree of purity of the potable waters of that city, and more recently, Professor Farlow, of Boston, performed a similar work at the request of the citizens of that city.† M. A. Gérardin,‡ however, has studied this question more closely, by observing the cryptogamic vegetation in small streams of water which receive the waste products from the factories and manufactories on their banks. M. Gérardin observed that each industry favored the development of certain peculiar species which were replaced by others in places where a different industry was in operation.

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*Atti Accad. Pontif. Nuov. Linc., 19th March, 1876.

†Ibid., 22nd January, 1877.

*A microscopic exam. of water . . . of London, 1850.

†Remarks on some Algæ found in the water . . . of Boston, 1877.

‡Rapport sur l'alteration, la corruption et l'assainissement des rivieres, 1873.

Acting upon the same idea, the Administrator of Bridges and Roads of the Seine and Oise sent us lately a difficult problem to solve. The problem was to disinfect a river on the environs of Beaumont, which, during the heat of summer, was poisoned by a cryptogam of the genus Leptothrix. This vegetable is an aquatic and filaceous fungus which thrives and grows on the refuse of factories. The only answer to make was the well-known axiom: *sublata causa tollitur effectus.*

M. Neuville, the author of the memoir of which we are treating, is astonished that a work similar to that which he has undertaken, has not yet been done for the waters of Paris, whose sources are different, and which, consequently, do not present an equal degree of purity. Regarding the question from a purely utilitarian point of view, he seeks to enlighten the administrator and the public on one of the great necessaries of life, that is to say, the water consumed each day, by making use of his knowledge of cryptogams, and chiefly those of the family of Diatoms, for the study of which he had a predilection.

The purity of water is not always to be measured by the greater or less quantity of organic matters that it contains; these matters have a purifying character in themselves, but this condition obtains only when they are living vegetable growths, containing chlorophyl or green matter, having the property, on the one hand, of freeing oxygen, which is then dissolved in the water, and of absorbing on the other, the carbonic acid gas which makes the water unfit to drink. Aquatic plants, then, are useful to the water which gives them shelter, provided that they do not, by their accumulation, counterbalance the salutary effects.

Another cause very often acts to give water unhealthy properties. The lime salts which it holds in solution, sometimes in great quantity, cause troublesome, and sometimes serious diseases. The carbonate, but above all the sulphate, of calcium, makes the waters calcareous, and then they become unfit for the cooking of vegetables, do not dissolve soap, and are indigestible. It is possible, however, for water to dissolve soap and nevertheless fail to cook vegetables; this occurs when, in place of sulphate of calcium, it contains that of magnesium.

The head-waters of streams are often sought after for their limpidity and freshness, which does not always imply that they are really potable; it is even probable that if the waters of our rivers were taken at their source they would not have the qualities which they acquire after a journey of several miles. But when these rivers pass through an important manufacturing city, the additions, the impurities of all sorts which they receive will rapidly change their qualities; defiled, so to speak, in the passage through the city, they are still able to improve themselves somewhat after a new journey in the country, which permits them to deposit the foreign matters which contaminate them. These elementary considerations should always lead us to insist that the waters which supply a city should be taken above, and not below, the city.

Borrowing from the interesting micrographic works of M. Miquel, of the Observatory of Montsouris, whatever they contain of use to his work, M. Neuville, among other things, reproduces the following table of comparison for the use of the reader, and shows what organisms the waters derived from different sources and of different qualities can contain, observed with considerable magnifying power:

PROPORTION OF LOW ORGANISMS CONTAINED IN DIFFERENT WATERS.

	Living organisms contained in a cubic centimetre.
Water of condensation	0.2
Rain water	35.0
Water of the Vanne	62.0
" " Seine, in Paris	1200.0
Sewer water	20,000.0

It is indispensable that analyses of this nature should be made rapidly, because in a short time the microbes increase to a great degree, and will no longer give exact figures.

The method which M. Neuville has followed does not consist of chemical analyses of the waters of Paris, which had been done long before by well-known scientists; it is rather a kind of statistics of the foreign matters contained in each of them, and which the use of the microscope reveals.

The waters submitted to his examination are those of the Marne, taken at Saint-Maur and Charenton; of the Seine, at the Port-à-l'Anglais, at the Bridge of Austerlitz, taken at Chaillot, Auteuil, and at Saint-Ouen; the waters of the canal of Ourcq, of the Vanne, of the Dhuis, of Arcueil, of the sources of the Nord of Paris, of the artesian wells at Grenelle and Passy, and finally that of a well on the left bank of the Seine.

A constant quantity of five litres of water was taken at the middle of the above-mentioned streams, or at the inlet of the waters of the sources; then after a settling of 12 hours, by means of an appropriate siphon, he decanted until it was reduced to 300 grammes. The contents were turned into a graduated gauge, and after rest, by the use of a small pipe, he gently raised the liquid in order to leave but a deposit of two or three centimetre cubes. It is this deposit which is directly submitted to microscopical observation, after having been mounted in the usual cells before being preserved. Observation was made on a determined number of preparations, all sketched under the camera lucida, and the sum of the latter serves to form one of the plates which accompany this article, which contains seventeen. A diagram, or schematic table, indicates the result of chemical analyses and of microscopical observations made for the Seine in its journey through Paris.

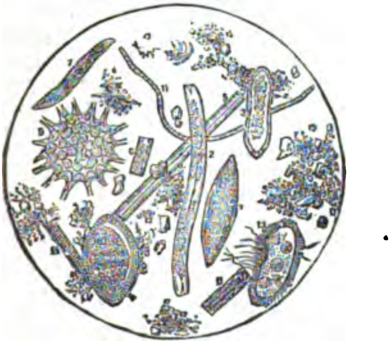

FIG. 1.—Water of the Marne at Saint-Maur.

The water of the Marne taken at Saint-Maur is relatively rather pure; yet organic matters are found in great abundance in it; but they are chiefly living matters, and more purifying than corrupting (Fig 1.) They are a part of the Desmids in the green matter and belong to the genus *Pediastrum* (No. 9) or *Raphidium* (No. 10); or else of filaceous algæ (No. 11) of the genus *Ulothrix*. On the other hand, and much more abundant, are the Diatoms with silicious carapace, and, for the most part, gifted with movements of translation very curious to observe. Such are the genera *Surirella* (No. 1), *Nitzschia* (Nos. 2 and 3), *Cymatopleura* (No. 4), *Synedra* (No. 5), *Diatoma* (No. 6), *Pleurosigma* (No. 7), etc., or even Infusoria (No. 13), which make prey of several of these small growths, but particularly of the organic remains. Finally the mineral matters which, in the water of the Marne river, are always more or less muddy, form the small crystalline groups in the preparation (No. 15). This water is then very good; but on approaching its confluence, that is to say, at Charenton, not only the diatoms are increased in number, but the infusoria abound in it as well as detritus, which probably is due to the inhabitants of Marne at this point.

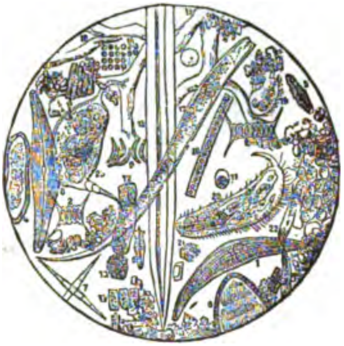

FIG. 2.—Water of the Seine at Port-a-l'Anglais.

In the water of the Seine taken at the Port-à-l'Anglais (Fig. 2), a very great proportion of organisms is found. This point of the river, intended at one time to furnish Paris with a very potable water, has lost its value on account of the factories and manufactories which are built on it above the city, and the length of the small streams of water which it receives in these places. Desmids are found in it—the genus *Closterium* (No. 1), *Scenedesmus* (No. 2), *Raphidium* (No. 9), *Tetraspora* (No. 10). and other algæ, as *Chlamidococcus* (No. 11), or *Ulothrix*. Infusoria equally (*Chætonotus* [No. 20], *Brachytous* [No. 23], *Euglena* [No. 12]) and several species of diatoms already named or a little different. But that which is striking is the already notable quantity of organic remains, fragments of plants (No. 24), mycelium of fungi (No. 18), and an anguillula (No. 17), moving about in the middle of all this multitude, and, in Fig. 2, crossing a spicule of spongilla (No. 15).

The water taken at the Bridge of Austerlitz contains more detritus; the purifying algæ disappear, and diatoms are rare. It is infusoria and their bodies which predominate; then, finally, there are remains of tissues of linen or cotton, of vegetables in decomposition, etc., which the waters of Bercy, of Rapée and Bièvre brought.

If now we pass by Paris, and examine a sample of water from the pump of Chaillot (Fig. 3), the maximum contamination of the Seine is attained. (If we except, however, the water taken at Saint-Ouen; but at this place the stream has received, as is known, the sewer collector at Asnières, which is a serious cause of contamination of the water for a long distance.) The quantity of carbonic acid has already increased, and the oxygen grown less.

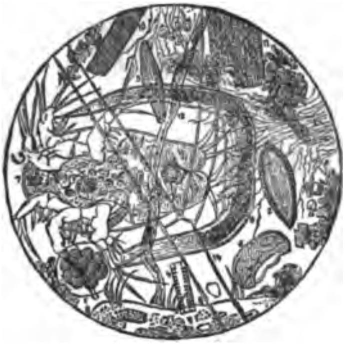

FIG. 3.—Water of the Seine at Chaillot.

In the Chaillot water (Fig. 3) there are scarcely any more algæ; here and there remains of conferva (*Cladophora* [No. 14]), or some rare specimens of more reduced species (*Pandorina* [No. 1]), *Chlamidococcus* [No. 5], *Surirella* [No. 2], *Stauroneis* [No. 3], *Epithemia* [No. 4]), yet most often there is only the silicious carapace, void of endochrome, of these last diatoms. On the other hand, the deposit of detritus is dominant in it: muscular fibres (No. 10), vegetable cellules (No. 11), then myceliæ of inferior fungi, and lastly anguillulæ (No. 9). Yet there is still more: some microscopic crustaceans appear (*Daphnia pulex* and others [Nos. 7 and 8]), the whole associated with earthy or indeterminable remains.

M. Neuville disputes the opinion of M. Frankland, who refuses to admit that rivers purify themselves. He maintains, which seems to be perfectly demonstrated, that after a tranquil journey without receiving other impurities, a river purifies itself little by little, by deposition, either on the bottom of the bed, or on the banks, of the substances which it held in suspension. The harmful matters held in solution are eliminated, and they disappear; the carbonic acid becomes exhausted little by little, and the oxygen, on the other hand, returns in proportion.

During the war of 1870-71, the forced stopping, on the rivers which habitually received the refuse, of factories and of industries polluting these streams, had changed their conditions. Thus the Bièvre, tainted from Arcueil to its arrival in the Seine at Paris, had again become limpid, and fish had made a home in it, coming from the parts above Arcueil, although, however, the bottom of the bed of the Bièvre was at this moment covered by a thick layer of mud, nauseating at ordinary times.

The water of the Seine at Saint-Ouen became again more impure than any other part; but, as has been said, this was due to the sewer collector of Asnières. The carbonic acid which, at the Bridge of Austerlitz, was represented by 16.2 per cubic centimetre, reached here the proportion of 65. that is to say, the maximum for the waters of Paris. Living creatures here are very rare; but the remains of stuffs: linen, yarn, cotton, animal and vegetable fibres abound here. It is no longer a deposit, it is a real soup. The chlorides, the sulphates, and the sal ammoniacs, as well as sulphuretted hydrogen, are largely represented here. Finally, further on, where the Seine passes by St. Denis and receives from it some quantity of refuse, vegetation is no longer found in it, and the bottom of the stream is nothing but a blackish and contaminated mud, as M. Gérardin observed it.—*Science.*

(*To be continued.*)

Effects of Optical Slits.

M. TREVE has lately described some curious effects. Looking through a fine slit at a vertical object (a post or a mast, for instance), he finds the perception much more distinct when the slit is horizontal than when it is vertical. On the other hand, to distinguish horizontal lines more clearly, the slit must be held vertically. But if, in general, one look at a house or a landscape through a fine slit, it is found that the maximum of brightness of the horizon is when the slit is horizontal. This effect, it is said, is also produced with the solar and lunar discs; they are seen much more distinctly with the horizontal slit. M. Treve has reproduced the effect by photography, and the negatives taken with the horizontal slit were more distinct. The light appears to be propagated with more intensity through the latter than the former, the vertical bands of solar photographs showing well the interferences and passage of light through a vertical slit. Again, if a cross-slitted disc be held between the sun and a white screen, the horizontal part of the cross on the screen is brighter than the vertical. The practical application of these experiments of M. Treve to photography would appear to be the relation which they bear to the shape of the apertures of diaphragms and to instantaneous shutters. Is it a fact with regard to the latter, that the uncovering of the lens horizontally admits more light, and therefore produces a picture more quickly than a shutter which opens vertically ? There may be no difference, but the point, at any rate, is worth deciding.—*Photographic News.*

Preservative Fluids for Botanical Preparations.[*]

IN 1872 MM. J. Groenland, M. Cornu, and G. Rivet published a little work[†] on the preparation of botanical objects for the microscope, in which they gave a series of formulæ which they had found useful. This work being now rare, M. G. Huberson has reproduced these formulæ as follows:—

No. 1. *Equal volumes of glycerin (as pure as possible), alcohol, and camphor-water.* This fluid will preserve, either in bottles or cells, the greater number of vegetable tissues, and especially all cellular tissues of a certain solidity, such as horny albumen, epidermis, sections of leaves, and all woody, fibrous, and vascular tissues. Certain preparations it renders too transparent, especially those of very young organs; a fault that is corrected by the addition of water. (For tissues with cystoliths Nos. 3, 4, and 5 are preferable.)

No. 2. *Three volumes of glycerin to two of camphor-water* may be put to the same use as No. 1, but only in closed cells.

No. 3. 100 *grammes of distilled water to two of chloroform.* Shake up together for five minutes at least. About 1 gramme of the chloroform is dissolved, the remainder is precipitated at the bottom, and serves to keep the fluid saturated. It is used for all tissues in course of development and still tender, prothallia, embryonal sacs, archegonia, and the fecundating organs of cryptogams in course of formation. (For the same parts completely developed Nos. 1 and 2 are preferable.)

No. 4. *The same as No.* 3, *with the addition of* 4 or 5 *grammes of glacial acetic acid.* This preparation preserves confervæ perfectly without contracting the chlorophyll, to which it merely gives a brownish tint. It presents one peculiar advantage in that it absorbs the air-bubbles which objects often contain after being placed in the cell. In this manner pith and fungi with numerous spores (Agarics, *Penicillium*) which often retain, do what one may, a large number of air-bubbles, can be prepared with success and without the necessity of taking numerous precautions. A few days after the cell has been closed, the air-bubbles, if not too numerous, will have disappeared. Consequently, whenever washing in alcohol is inconvenient, this fluid should be used.

The acetic acid destroys the calcareous concretions which sometimes exist on the surface and even the interior of algæ. Bubbles of carbonic acid are in this case given off, and for some days spoil the appearance of the preparation, but they disappear before long. The proportion of acid is pretty strong, but experience shows that a slight excess of this acid is not injurious.

No. 5. *Camphor is dissolved in chloroform until it is saturated.* The superfluous camphor is as far as possible removed and fresh chloroform equal in amount to the first is added. Four grammes of this solution is dissolved in a litre of distilled water; no precipitate being produced.

This fluid may in most cases replace No. 1. It gives less transparency to the preparations, but it possesses the advantage of but slightly contracting the primordial utricle. For this reason it may be employed for preserving even the most delicate marine and freshwater algæ, desmids, diatoms, with their endochrome, etc. For the very delicate algæ, such as the confervæ (*Spiroggra*, *Rhynchonema*, etc.) preference is given to the following:—

No. 6. 75 *grammes of camphor-water,* 75 *of distilled water, and* 1 *of glacial acetic acid.* This formula was invented by Dr. Ripart and cannot be too strongly recommended.

No. 7 *is a gummy mixture* for fixing the objects in the cells before putting in the preservative fluid. Dissolve, cold, completely white gum arabic in twice its weight of camphor-water, adding to the solution, which is not perfect till the expiration of two or three days, three-quarters of its weight of glycerin. It should be kept several months in a long narrow bottle till the fluid has become completely limpid through the deposit of the corpuscles which it at first holds in suspension.

No. 8 *is a gelatinous mixture* intended to replace Canada balsam. Soak perfectly white gelatin in cold water for about twelve hours, drain it, and set the vessel which contains it in warm water. When it is melted mix an equal volume of glycerin with it. The mixture solidifies on cooling. When required for use it is liquefied by plunging the vessel containing it in warm water.

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[*] Brebissonia, iii. (1881) pp. 104-8.

[†] Des preparations microscopiques tirees du regne vegetal et des differents procedes a employer pour en assurer la conservation. (8vo, Paris, 1872.) 76 pp. and figs.

No. 9. 500 *grammes of distilled water and* 1 *of phenate of soda.* This fluid will preserve (in cells only) a host of vegetable tissues and microscopical plants. The previous formulæ are in general preferable, but in cases where they do not answer this fluid may be tried, especially for objects which are very delicate and very sensitive to the effects of endosmosis.

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Arabin for Mounting Microscopical Objects.*

IT will have been observed that, when a solution of gum Arabic has been used as an adhesive medium for attaching diatoms or other delicate material to slips, that there is often present a granular appearance, which is owing to the earthy matters contained in the gum. It is impossible to get rid of this by the most careful filtration, these earthy matters being soluble in the same liquids as the gum itself. As there is no adhesive medium so suitable as gum for microscopical purposes, I have thought that a preparation of perfectly pure gum, free from the objection thus mentioned, would be of some value to microscopists. Such a medium I find in the body known to chemists as Arabin, and which is in reality gum Arabic from which these impurities have been removed.

To obtain Arabin for microscopical use, gum Arabic should be selected as clear and white as possible. This is to be dissolved in distilled water to the consistence of thin mucilage. It should then be filtered, and the filtrate poured into rectified alcohol, and well shaken. The Arabin immediately separates as a white pasty mass, and the whole becomes semi-solid. It must be placed on filter-paper, and washed with alcohol, until the washings are perfectly free from water, and the alcohol comes off as pure as it went on. The Arabin may now be allowed to dry spontaneously. The edges of the surface of the mass will probably be found to be viscid, owing to the absorption of water from the atmosphere or from the alcohol—but the remainder will be a perfectly pure white powder. This should be shaken off the filter and preserved.

Arabin possesses for microscopical purposes all the properties of ordinary gum. It is freely soluble in water (more readily so than gum), insoluble in alcohol.

Like ordinary mucilage, it is very liable to become mouldy if kept in solution, but when once dry on a slip it undergoes no change, and shows, at least as far as my own observation is concerned, no deterioration after a considerable time. It is undoubtedly a troublesome and expensive matter to prepare, owing to the quantity of alcohol required, but, when once obtained, a little of it goes so far that practically it costs little. Methylated spirit must not be used in its preparation, as, containing always a proportion of shellac or other gum resins, this is sure to remain as an impurity.

For use, a portion should be dissolved in distilled water to any required consistence, and passed twice through filter-paper, which should have been previously washed with distilled water. It may then be placed on the slips, drained, allowed to dry, and the slips put away for use. In this condition, and with ordinary precautions as to dust and damp, it may be preserved indefinitely.

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THE WAX CELL.—After describing a method of mounting objects in wooden slides, the floor of the cell being covered with wax, Mr. Henry J. Roper says: "I see that an American professor is discarding a somewhat similar method on account of, as he says, 'the covering glass, sooner or later, becoming covered inside with a dew-like deposit, which, when illuminated, will glisten like so many minute points of quicksilver.' I have myself noticed this occasionally in specimens mounted something in this style, on *glass* slides, but very rarely (not perhaps one per cent.) when mounted on wooden ones; and then no doubt the wax was used when too new, sufficient time not having been allowed for its volatile properties to evaporate; it is probable, too, that the wood itself may absorb the slight moisture which, in the case of the glass, can obtain no other refuge than the covering glass; at any rate, speaking from one's own experience, I have found no inconvenience on this score, after mounting many hundreds of slides, extending over several years.

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SOAP FOR IMBEDDING.—A medium very suitable for imbedding, which I have used at the suggestion of Dr. J. G. Hunt, of this city, is the ordinary transparent soap of the shops, which is cut into small pieces and melted in a water-bath with the aid of alcohol. It may be prepared in considerable quantities. poured into a bottle, and when desired for use the bottle need only be placed in a vessel of water for a few minutes, when the imbedding material is ready for use. Its advantages are its cleanliness and transparency.—*Tyson's Practical Histology* (1873).

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* H. J. Waddington, in "Journal of Quekett Microscopical Club."

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Size and Nomenclature of Eye-pieces.

At the Detroit meeting of the American Society of Microscopists the following resolution was adopted:

Resolved, That the past-President, President, and President-elect be appointed a committee to report at the next meeting of the Society upon the amplifying powers of eye-pieces and the proper corresponding nomenclature, and to suggest measures leading to uniformity in the latter.

At the Columbus meeting this year this committee was continued, and the President for the present year added to it.

If uniformity in nomenclature and size of eye-pieces can be established, it will, doubtless, prove as great a convenience to makers and users of the microscope as the adoption of the society-screw for objectives.

Of course the co-operation of makers and dealers is essential to even the preliminary steps of this movement, and the committee has issued the following series of questions to which all makers of microscopes are requested to send answers to Prof. R. H. Ward, M.D., 53 Fourth street, Troy, N. Y., U. S. A.

Proper blanks have been transmitted to all dealers and makers, but if any have been overlooked we feel assured that Dr. Ward will, on application, very gladly supply the omission.

The following is the circular referred to:

First Question.—Please give list of various eye-pieces or oculars for the microscope made by you, with construction (Huyghenian, Orthoscopic, Periscopic, etc.), with the equivalent amplifying power of each, at a standard distance of 10 English inches or 254 mm.

Second Question.—Please state how you determine the amplifying power of your eye-pieces.

Third Question.—Do you consider it desirable that a uniform nomenclature (with reference to amplifying power) of eye-pieces should be adopted by makers of microscopes?

Fourth Question.—Will you adopt such a nomenclature if decided upon by this Society?

Fifth Question.—Please suggest such a nomenclature which seems to you most generally applicable and desirable.

Sixth Question.—Do you consider it desirable that eye-pieces should be so constructed—by means of a shoulder or other device on the longer ones—that all should pass the same distance into the tube of the microscope, thereby preserving the blackening of the inside of the microscope tube?

Seventh Question.—Please give inside diameter of microscope tube, or draw tube where there is one, or outside diameter of that portion of eye-piece fitting into the microscope tube for each size of stand made by you.

Eighth Question.—Do you consider it desirable that two, or three, or more *standard diameters* of tube for microscopes be generally adopted with a view to interchangeability of eye-pieces?

Ninth Question.—Please suggest the number of sizes and the inside diameter of tube in each case which you would recommend for adoption.

Tenth Question.—Will you adopt a standard set of sizes if agreed upon and recommended by this Society?

Eleventh Question.—Please give this committee the benefit of any suggestions not included in the above answers.

The answers to these questions are to be transmitted to Dr. Ward, who is chairman of the committee.

The Water of Paris.

THROUGH the kindness of Prof. Michel, Editor of *Science*, we are enabled to present to our readers a resumé of the article on this subject which recently appeared in *La Nature*. Our readers, who have had an opportunity of examining the elaborate paper of Mr. Vorce on the organisms found in the Erie water at Cleveland, will be interested in comparing the two.

Our Book Table.

Marine Algæ of New England and Adjacent Coasts. By W. J. Farlow, M.D. Reprinted from Report of U. S. Fish Commission for 1879.

It is an unfortunate fact that when a writer like Prof. Farlow contributes an able article on some scientific subject to a Government Report it might almost as well be buried. To the quiet, modest student—the one who would derive most advantage from it—it is almost inaccessible. In the first place it is only by chance that it will be brought to his notice, and in the second it too often happens that he is unable to procure it. We are, therefore, very glad to see that this valuable monograph has been printed separately, and as the U. S. Fish Commission is composed of men who are themselves students, we feel assured that no earnest seeker after knowledge need fail in getting it.

The object and scope of the work is best set forth in Prof. Farlow's own words. He says:

' This report is intended, with the exception of the Diatoms, to include all the marine species at present known to occur on the coast of the United States from New Jersey to Eastport, Me., and a few species are mentioned which, although they have not yet been found within our limits, are nevertheless to be expected from the fact that they occur on the neighboring coast of the British provinces. In preparing the report I have attempted to present, in a compact and more or less popular form, a description of the different orders and species of sea-weeds, so that persons who frequent the coast of New England, and especially those in the service of the Fish Commission, may have at hand the means of determining the forms found in our waters. The descriptive portion of the report is preceded by a short account of the general structure and classification of sea-weeds, which is necessary in the present case, because there is no generally accessible book in the English language which gives a good account of the modern views of the classification and structure of algæ."

The use of the sea-weeds in commerce is thus tersely set forth by the author:

" From an economical point of view, but little need be said with regard to our sea-weeds as an article of food. *Chondrus crispus*, the Irish moss, as is called in this country, is the only species of any commercial value. It is collected in considerable quantities at several localities, but especially at Hingham, Mass. It is used for making sea-moss farine, and is also employed to some extent by brewers for clarifying beer. As yet the use of *Porphyra vulgaris*, the laver, one of the common species for making soups, has not been introduced. The Chinese employed in the shoe factories at North Adams, Mass., import the same species from China, not apparently knowing that they could obtain an abundance of it in Massachusetts. The dulse, *Rhodymenia palmata*, is sold to some extent in the seaport towns.

especially in Boston, where it is eaten principally by sailors and the Irish population. It is generally imported from the British provinces, but it could be obtained in abundance anywhere north of Boston, or even in some places in Long Island Sound. The great use of our sea-weeds is for the purpose of making fertilizers, and immense quantities are carted from the beaches and spread over the land near the shore. Usage, however, varies at different localities, for at Eastport the larger sea-weeds, which are practically the same species that are highly esteemed in New Hampshire and Massachusetts, are considered of little value in comparison with animal manure. As far as I know, there are no manufactories of iodine or soda salts on our coast, although our species greatly resemble those used in Scotland for the purpose. The stem of the devil's aprons, *Laminariæ*, are used by surgical-instrument makers in the manufacture of sponge-tents."

The work is illustrated by fifteen plates, the figures in which are very characteristic and beautifully drawn.

Lectures in a Workshop: By T. P. Pemberton, formerly Associate Editor of the "Technologist;" Author of "The Student's Illustrated Guide to Practical Draughting." With an appendix containing the famous papers by Whitworth "On Plane Metallic Surfaces or True Planes;" "On an Uniform System of Screw Threads;" "Address to the Institution of Mechanical Engineer's, Glasgow;" "On Standard Decimal Measures of Length." $1.00. New York: Industrial Publication Co.

The volume before us consists of a series of lectures and articles specially addressed to young mechanics. Several of these lectures were delivered before the Polytechnic Association of the American Institute, and were received with very great favor. The whole has been carefully revised and the unavoidable repetitions of an unconnected series having been cut out and other and more valuable points enlarged. The collection now forms a sprightly, fascinating book, full of valuable hints, interesting anecdotes and sharp sayings. It is not a compilation of dull sermons or dry mathematics, but a live, readable book. The papers by Whitworth, now first made accessible to the American reader, form the basis of our modern systems of accurate work.

The Compend of Anatomy. For Use in the Dissecting Room and in preparing for examinations. By John Roberts, A.M., M.D., Lecturer on Anatomy and on Comparative Surgery, in the Philadelphia School of Anatomy, etc., etc. Philadelphia: C. E. Roberts & Co.

This is a handy little volume, judiciously arranged and well adapted to the purpose for which it is intended.

The Medical Record Visiting List for 1882. New York: William Wood & Co.

This is a very neat and substantial list, published at a price which is little, if any, more than that of a common diary of similar quality. It contains the usual almanac and medical constants, and seems to us to be just the thing that a physician wants.

The Vision; or Hell, Purgatory and Paradise of Dante Alighieri. Translated by the Rev. Henry Francis Cary, A. M., with the life of Dante, chronological view of his age, additional notes and index. Illustrated by Gustave Dore from the last corrected London edition. In two volumes. Vol. II. New York: Carl Von Buren, 104 John St.

Some time ago we had the pleasure of examining the first volume of this book, and now the second volume, which completes the work, is before us. In these two quarto volumes we have the finest edition of Dante now accessible to the American book buyer. The paper and typography are of the best, so that it is really a pleasure to read it. As for the work itself, it has long since passed beyond the judgment and criticisms of all but specialists. Of the illustrations by Dore, however, it may be permitted to us to say a word. It has always seemed to us that of all the works suited to Dore's peculiar genius, Dante's vision justly claims pre-eminence. The curious mixture of religion and imagination; of brilliant fancies, subtle allegories and pointed teachings which the facile pencil of Dore is so well fitted to embody in the engravings, is just the combination which Dante, of all men, is fitted to draw forth. The Dante of Dore must, therefore, always hold a high place in the estimation of all students of the higher class of poetry. The only difficulty hitherto has been the very high price of the folio editions. Here, however, we have in handsome quarto form a most perfect fac-simile of the larger editions, and we predict for it a most favorable reception on the part of all lovers of art.

Correspondence.

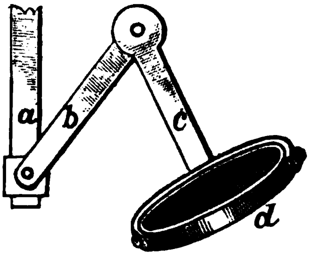
The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Microscope Mirrors.

Ed. Am. Jour. Microscopy—In your number for June is a communication from a person who owns a Zentmeyer's *Intermediate.* He says that he had some trouble on account of the mirror bar not swinging above the stage, and he gives his remedy for this defect.

I am the happy possessor of an *Intermediate Stand*, and I have got over the difficulty in a very simple way. I have removed a portion of brass between the guide, which slides on the mirror bar, and the piece which screws into the mirror. In this space, which is about one-quarter of an inch thick, I have inserted two arms jointed together. One end of one arm is jointed on the piece which slides over the mirror bar, and the end of the other arm is jointed to the piece which screws into the mirror.

In the accompanying sketch *a* is the mirror bar, *b* and *c* are the arms, and *d* is the mirror. If the piece *a* was stationary, the pieces *b* and *c* would serve, as arms of this kind serve in the microscopes of the best English makers, such as Powell & Lealand, Crouch, etc., to get oblique light. As in my instrument, the piece *a* swings, I generally keep the pieces *b* and *c* folded in front of *a* when the mirror is below the stage. When the mirror is to be placed above the stage, the piece *a* is placed horizontally, the pieces *b* and *c* are unfolded, and the mirror raised to any required height above the stage.



A friend who owns one of Mr. Geo. Wale's excellent instruments is now having his mirror placed on a series of three arms analogous to *a*, *b* and *c*, so as to carry it above the stage.

P. C.

Brooklyn, June 9th, 1881.

Current Notes.

Parasitic Worms in Fish.—Mr. Frederick W. True, of the Smithsonian Institute, who has taken up the little known subject of intestinal and other parasitic worms, states in the *Forest and Stream* that fishes are more or less populous with these tenants. The salmon has 16 different kinds; the pike at least 20, and the carp as many as a dozen in its native waters. None of them, however, resemble trichinæ "except as a garter-snake resembles a copperhead;" and they are as harmless when eaten as worms in cherries, being out of their element in the stomach of the warm-blooded human. Mr. True invites anglers and sportsmen generally to advance the study of American helminthology by preserving in spirits and sending to him at Washington, D. C., any specimens of parasitic worms which they find in game, fish, and other animals.

North American Review.—The editor and proprietor of the *North American Review* announces that the *Review* will be hereafter published at No. 30 Lafayette Place, and will appear under its own imprint. He states that he has found it impossible to conduct the publication in the spirit of the motto adopted by its founders, making it a forum of independent thought, and extending, at his discretion, the hospitality of its pages to thinkers and scholars of all creeds and forms of belief, and at the same time to maintain relations with a publishing house having extensive school-book and other interests of its own to promote. This change of imprint will involve no alteration whatever in the organization or service of the *Review*.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

TO MICROSCOPISTS.

THE annual meeting of the Iowa State Medical Society meets in Des Moines, January 25—27, 1882. On the evening of the 26th the microscopical section will convene and we should like to see as many persons present as possible, no matter whether medical men or not. All interested in microscopy are cordially invited to meet with us and to bring their microscopes, etc., with them. The ladies are especially invited. We desire to make it a social occasion. The science of microscopy is insinuating itself into the very fabric of our social, manufacturing, professional and scientific pursuits, and he who persistently neglects it will ere long find himself in the rear enshrouded in darkness. Wake up! Wake up! Old Rip Van Winkle. The world has moved since you fell asleep.

J. J. Mangear, President of Section, Ft. Madison, Iowa; W. D. Middleton, Secretary of Section, Davenport, Iowa.

State Microscopical Society of Illinois.—The regular meeting of the State Microscopical Society of Illinois for November was held at its rooms in the Academy of Sciences, 263 Wabash ave., Friday the 11th at 8 P. M. The President, Dr. Curtis in the chair.

Owing to the unavoidable absence of Dr. Mercer, the paper announced for the evening was postponed.

Mr. Langguth exhibited a new stand by Beck, of London, called the "International," and described its leading features as follows:

"One of the most striking and important improvements introduced in this stand is the compound stage, which is of entirely new construction. It has the usual mechanical movements and revolves in a circular ring. The revolution can be effected, gradually, by means of a milled head, or quickly by throwing that out of gear and turning with the hand. Two small ivory studs are provided for the convenient execution of the motion. Another milled head back of the limb of the stand rotates the stage vertically, the amount of the rotation being registered on a circular plate placed behind the stage. An iris diaphragm provided with a dove-tailed fitting is worked by a milled head beneath the stage. The swinging sub-stage is provided with a rack and pinion movement, and a milled head for slow angular motion, or this can be quickly disconnected and the sub-stage be swung to any desired point. A graduated circle back of the stage shows the angle of the sub-stage with the axis of the instrument. The mirror bar is fixed as in the older stands of their construction, but the mirror can be readily removed from the bar and attached to the swinging sub-stage. The entire sub-stage can be moved vertically through a distance of about three-fourths of an inch by a lever back of the limb of the stand. In answer to a member, Mr. Langguth stated that the cost of the stand was $450.

The meeting was then declared informal.

E. B. STUART,
Secretary *pro tem.*

Philadelphia Academy of Sciences.—To the members of the Lancaster Microscopical Society we are indebted for a report of the annual soiree of the Biological and Microscopical Sections of the Academy, held in the auditorium of their magnificent building at Nineteenth and Race streets, in that city, Nov. 18th, 1881. At a few minutes before 8 o'clock the doors were thrown open, and the rooms were soon crowded with the *élite* of the city. An address of welcome to the friends of the members of the society was extended by Rev. Dr. McCook, of Tabernacle Presbyterian Church.

The Lancaster Societies (both the Microscopical and the Philosophical) were well represented. Amongst those present were Prof. Rothrock, Dr. Green, Prof. Sharpless, Dr. McClurg, etc. The neighboring societies (those of Camden and elsewhere) seem to have been represented in force, and the meeting was a most enjoyable as well as a most instructive one.

Microscopical Society of Liverpool.—The eighth meeting of 13th session was held at the Royal Institution, Colquitt Street, on Friday, the 4th of November, 1881. The following gentlemen having been ballotted for, they were elected ordinary members of the Society:

John Pennock, 11 Marmion Road, Sefton Park; Henry Kendall, 15 Marmion Road, Sefton Park; Harold Swift, 22 Wellesley Road, Prince's Park; Alfred Clay Abraham, 117 Hartington Road; Edward Rosling, 35 Devonshire Road, Claughton; Rev. Henry E. Martin, Woodlands, Garston.

The paper of the evening was read by the Rev. Henry H. Higgins, M. A., "On the Sea-Lily Pentacrinus," of which the following is a digest:

The meridian of the Sea-lilies, Pentacrini, seems to have been reached in the seas of the mountain limestone, where they covered thousands of square miles, and became constituents of sedimentary rocks many hundreds of feet in thickness. Their extreme beauty and complexity of structure, if attained by natural selection, points to a pedigree of immeasurable antiquity, concerning which nothing is known. The sea-lilies have been placed near the polypes, but the latter are radiate in type, the former are annuloid; the latter have a good canal open to, or constituting the body cavity. The former have a distinct good canal with oral and anal apertures; the latter have no neural regions; the former have a nervous system branching from a ring with pseudo-ganglia, the latter have thread-cells; the former are without thread-cells; the latter generally are composite; the former are always simple. The annuloid structure of the sea-lily has nothing whatever to do with the ringed appearance of the stem. The segments, which are five in number, are "ringed" in a horizontal plane like the figures on the dial of a watch laid on a table. This is true of all the Echinodermata. The Star-fish is therefore *not* a rayed animal. From an example of a "mend" in a fragment from the plume of a sea-lily, the subject of the restoration of lost parts, led to the following remarks: How a speck of plasma having from its position a special junction can take upon itself to change that junction, and charge itself with the duties attached to a fertilized ovum, at the same time having its embryological potency modified so as exactly to suit the special requirements of a situation determined by an accident—is an inquiry from the threshold of which he that assumes to be scientifically rich must be sent empty away. It is, however, in the regions of the unknown that the noblest rewards of future observers lay hidden. Whether the highest prize may be the discovery of truth, or the habit of mind developed in the search after it—one thing is sure—nature is a field where honest toil never terminates in disappointment.

A vote of thanks was accorded to Mr. Higgins. At the conclusion of which the meeting resolved itself into a conversazione, when the following subjects were illustrated:

Anacharis, in decay—with high power, George F. Chantrell; cabinet slides, recent, Alfred Leicester; cristatella mucedo, A. T. Smith, Jun.; desmids and diatoms, George F. Healey; diatoms, T. W. Bruce; diorite, section, Henry C. Beasley; diptera, species of, W. H. Weightman; foraminifera, various, I. C. Thompson; hairs of various animals, H. R. Boult; hydra viridis, Dr. McClelland; ova of planorbis, showing rotation, J. T. N. Thomas; ovum of hydra, in amœboid state, George F. Chantrell; rotatoria—stephanoceros, floscularia, and melicerta, Charles Botterill; seeds of digitalis, Thomas C. Ryley; worms from wine corks, H. M. Bennett.

San Francisco Microscopical Society.—At the regular meeting held Monday evening, August 22d, Mr. C. W. Banks, through the politeness of Messrs. Hatteroth & Ross, agents of R. & J. Beck's instruments in this city, exhibited Beck's new "Ideal Microscope" to the members. The instrument is novel in design and beautiful in construction, and will exactly meet the wants of a large class of persons who want a good instrument at moderate cost.

Charles H. Denison, Esq., the secretary, read a paper on "The Formation, Uses and Value of Sand." Forty-five different kinds of sand were shown under the microscope, including samples from every quarter of the globe. The claim was made that ordinary sand has been of more value to the world during the last thirty years than all the gold taken from the California mines.

West Chester Microscopical Society.—The regular meeting was held at the residence of Addison May, on the evening of Nov. 10th, with a very full attendance of members and invited guests. President Rothrock in the chair. The minutes of the last meeting were read and approved. A report of members who attended the late soiree of the Lancaster Society was read and approved.

An invitation from the Biological section of the Academy of Natural Sciences, of Philadelphia, to attend their annual entertainment, was accepted, and the Executive Committee directed to ascertain how many members would attend, and make necessary arrangements.

A. Sharpless then read an essay upon "Life and Death of the Planetary System," which was supplemented by a few exceedingly interesting remarks upon the same subject by Prof. G. M. Philips. Dr. Rothrock gave a short but very interesting lecture upon the birth of plant life, illustrating the same upon the blackboard, much to the interest and edification of all present. At a late hour the meeting adjourned for an examination of the numerous interesting exhibits under the microscopes.

EXCHANGES.

A Wales' first-class one-fifth, 170°, wet and dry fronts, adjustable, for a first-class one-half or four-tenths, which must be of wide aperture and adjustable. Allen Y. Moore, M. D., 121 St. Clair St., Cleveland, Ohio.

A villiage cart (used one season; Flandreau maker) for a first-class Binocular microscope. Address "Beardsley," Box 2852 N. Y. P. O.

Very fine stereoptican with eight inch condenser, value $75, for a good microscope suitable for photographic purposes, or would give first-class photographic portraiture. Rockwood, 17 Union Square, New York.

Sole skin and fossil wood (showing fern structure) from Iowa coal, for other good material or mounted objects. John Walker, Minneapolis, Minn.

A Ballard breech-loading rifle, in good condition, for a good spectroscope. D. L. H., Box 58, Kingsville, Ohio.

A small 3 draw telescope with sun-glass, made by Dolland, London, for a 1-16th objective of moderate angle, by any first-class maker. Dr. Mercer, 37 Twenty-sixth St., Chicago.

Wanted, a small microscope stand or accessories, for an Amer. Optical Co. 8 x 10 double-swing back camera, very suitable for micro-photography. Has been used a few times only. F. F. Stanley, Swampscott, Mass.

Living Volvox Globator, in any quantity, for mounted algæ or other slides. St. Lawrence River or Northern New York algæ; desmids and diatoms for same, in other places. J. M. Adams, Watertown, N. Y.

Birds' eggs and whole insects in exchange for mounted objects of any kind, in good condition and well mounted. W. J. M., Box 201, Moorestown, N. J.

Fine fern-leaf copper crystals, arranged, and named diatoms; fine histological and pathological specimens; sections of teeth—the latter on the ground-glass slides, used at Geological Hall, Albany, N. Y. The above are all nicely mounted, and only first-class slides are required in exchange. Dr. Robt. Dayton, 559 Euclid Ave., Cleveland, O.

Will exchange mineral specimens of Idaho (for cabinet or microscopic use) for well-bound books of an instructive nature. Send list of books with particulars. John Chorette, Junction, Lemhi Co., Idaho.

Chara in fruit fully ripe, structure of sporangia, antheridia and antherozooids, easily shown, for the asking W. W. Munson, Otiseo, Onondaga Co., N. Y.

Wanted offers of new scientific Books in exchange for Leidy's rhizopods. H. M., 162 Fargo Ave., Buffalo, N. Y.

A few well-mounted slides of parts of insects, such as heads of flies, stings and tongues of bees, to exchange for other well-mounted objects. H. S. Woodman, P.O. Box 87, Brooklyn, E. D., N. Y.

Good uncleaned diatomaceous material, containing Arachnoidiscus, Heliopelta, Triceratium, Isthmia, Pleurosigma, Surirella Gemma, and Terpsinoe Musica, wanted in exchange for well-mounted slides of arranged diatoms, etc., or cash. Danl. G. Fort, Oswego, N. Y.

Well mounted histological and pathological slides in exchange for other first-class slides. Lewis M. Eastman, M.D., 349 Lexington street, Baltimore, Md.

Wanted, about 2 ounces of fossil deposit from Bemis Lake, or any other containing the largest form of N. rhomboides. Liberal exchange from list will be given by E. Wheeler, 48 Tollington Road, London, England.

First-class slides, palates of marine molusca and other marine objects, for first-class rock sections or crystals, cabinet or microscopic specimens; lists exchanged. Rev. J. D. King, Edgarton, Mass.

Diatoms in situ, and free algæ, and other material, animal, vegetable, and mineral, to exchange, by list, for material or mounted objects; none but first-class objects offered or desired. M. A. Booth, Longmeadow, Mass.

Beautiful Beryls, Garnets, Tourmalines, Rose Quartz, Muscovite, Granites in variety, etc., to exchange for coins, shells, fossils, minerals, books, magazines—anything. Describe offers fully. C. Le R. Wheeler, Wilmot, Merrimack Co., N. H.

Over 100 new first-class transparencies for the lantern, to exchange for microscope accessories; a first-class 1-12, 1-4, and 1 inch objective wanted. Box 107, Astoria, L. I.

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AND
POPULAR SCIENCE.

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The Waters of Paris.—II.

THE canal waters of Ourcq have been for a long time the principal source of the supply of Paris. They are calcareous; yet M. Neuville does not consider them the worst waters used in the city. A great number of algæ live in them, this being in their favor, and their relative tranquility is also one of the causes of this notable growth of vegetation. Must not the numerous boats which sail on these waters and the warehouses bordering this canal, where unloading is done, prove sources of pollution of these waters? Their hydrometric degree is 30° to 31°, while the mean of the waters of the Seine is between 17° and 20°, but this does not constitute in the eyes of M. Neuville a plausible reason of inferiority for the waters of Ourcq. It is their stagnation which ought to be the dominant cause of their depreciation.

Fig. 4 represents the organisms obtained from the waters of the Vanne. It is, according to microscopical observations as well as according to the official reports, the best of the waters of Paris. M. Belgrand says: "Comparison was not possible between the excellent waters of the Vanne and those of the Seine and the Ourcq, which, warm in summer, cold in winter, muddy and opaque in all seasons, are besides tainted more and more by the residue from industrial and human refuse. After a journey of 176 kilometres by means of closed inlets, the waters of the Vanne arrive at the reservoirs of Montsouris and can furnish 100,000 cubic metres of water in 24 hours. Limpid, fresh, exempt from organic matters, it unites all perfections, says M. Neuville; it is water that I wish to see distributed in all Paris."

Several algæ of good quality, such as *Ulothrix* (No. 7), *Melosira* (No. 2), *Meridion* (No. 1.), *Navicula* (No. 3), and *Synedra*, are the respectable inhabitants of these waters; here and there some vegetable growths and earthy remains, and finally some crystals of carbonate or sulphate of calcium (No. 11).

The waters of the Dhuis (Fig. 5) only arrive at the reservoirs of Ménilmontant, associated with those of the Surmelin. At their point of junction, those of the Dhuis appear rather pure, but nevertheless they are muddy and have need of rest. It is a remarkable thing that the microscope reveals no algæ in them; on the other hand, organisms of another order are met with, some filaments of Mucorinées (No. 1), mycéliæ (No. 2), and some earthy or organic remains (Nos. 4, 5, 6). According to all appearances, these waters are not sufficiently oxygenated, and a further journey in the open air and in the light will make them perfect.

Rivalling the waters of the Vanne for purity and freshness, the reputation of the waters of Arcueil has been known for a long time (Fig. 6); they were so named because they flow through the valley of the Bièvre over an aqueduct at Arcueil. But in truth, they have come from the village of Rungis since the Roman epoch, for these are the waters which supplied the baths called baths of Julius Cæsar or thermæ of Cluny. To the Roman aqueduct, of which several traces remain, succeeded that which can now be seen, built by Desbrosse in 1624, which has to conduct the waters of Rungis to the palace of Luxembourg and in the Saint-Jacques quarter. Advantage is taken of this monument, solidly constructed, to build above it the new aqueduct for the waters of the Vanne, which are conducted to the basin of Montsouris. M. Neuville says: "With difficulty can be seen in them, several Vorticellæ and Oscillatoriæ (Nos. 1, 5, 6), then several diatoms (*Gomphonema* [No. 3], *Nitzschia* [No. 2]) and lastly some salts of calcium, crystallized and precipitated from their solution by the loss of a portion of carbonic acid. It is water of good quality, which can be improved by means of successive cascades, and it is unfortunate that we have not more of it.

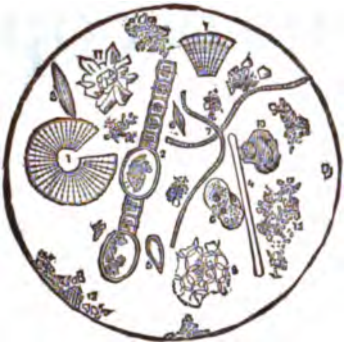
Fig. 4.—WATER OF THE VANNE.

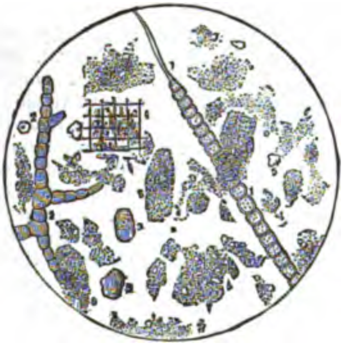
Fig. 5.—WATER OF THE DHUIS.

The sources of the Nord of Paris offer but little interest. Given up to the consumption of the inhabitants of Paris from the end of the twelfth century, they were for a long time the only waters which supplied the fountains of the capital. These, with the waters of Arcueil, are the most ancient known. They are furnished by Saint-Gervais and the heights of Belleville. Their quality leaves much to be desired.

"Essentially calcareous, their hydrometric degree reaches enormous proportions: 100 degrees to 150 degrees, according as the waters of Saint Gervais and of Belleville are more or less mingled." They contain very little organic matters, some rare algæ, and many calcareous crystals.

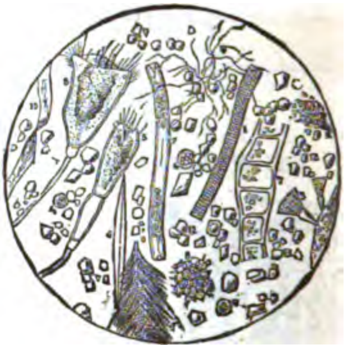
Fig. 6.—WATER OF ARCUEIL.

The well of Grenelle, now celebrated, was commenced in 1833 and only finished in 1841. It was on the occasion of its boring that the relations of the elevation of temperature to the depth of the soil observed by Arago and Walferdin, were stated; that is to say, with every 32 metres the temperature rises one degree.

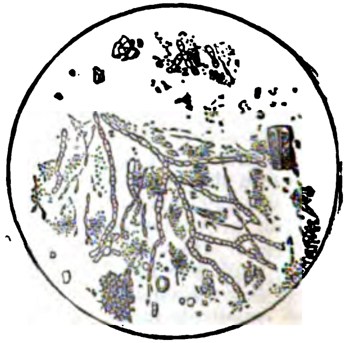
Fig. 7.—WATER OF THE WELL OF GRENELLE.

The water of the well of Grenelle (Fig. 7) lacks oxygen, which it can gain in the basins of the Pantheon whither it is conducted. This water is limpid, indicates at its outlet about 28 degrees, and is very nearly pure from all organisms, since it only contains some traces of mycelium of fungi (No. 2), and, here and there, several diatoms (No. 1) probably drawn from the tubes through which it flows. The traces of sulphuretted hydrogen which it contains impair a little the quality of this water, but not enough to make it unfit for consumption.

The water of the well of Passy, bored between 1854 and 1861, resembles that of Grenelle (Fig. 8). The results which the piercing of this well caused are known; the sale of the water of Grenelle was considerably lessened. The carbonate of lime, as well as the bicarbonate of potash, are abundant in both. All things equal, moreover, M. Neuville expresses his preference for the waters of Passy rather than for those of Grenelle. Several algæ are found in them (*Calothrix* [No. 8], *Rhizoclonium* [No. 5], *Cosmarium* [No. 1], Glœocystis [No. 9]); several encysted infusoria (No. 2), and a few unimportant organic remains.

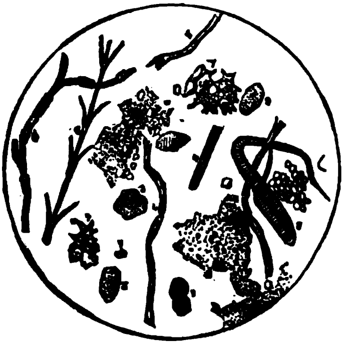

Fig. 8.—WATER OF THE ARTESIAN WELL OF PASSY.

Lastly, the waters of ordinary wells are potable only when they are not found in a great city. The varied infiltrations, the connection with the soil, and the industries which can contaminate them, are considerations which must be taken into account in deciding the quality of the waters of wells, and which can render them unfit for consumption. They contain at Paris much of the nitrate and sulphate of lime, and they are also heavily charged with organic matters in a state of decomposition; but of algæ there is no trace, and there are, here and there, several microscopic crustaceans. It is above all in the neighborhood of cemeteries that the waters of wells should not be used, except for coarse purposes. This advice is upheld by the studies of M. Belgrand, who has observed that, in the environs of Père-Lachaise and of the cemetery of Montparnasse, the waters of wells were poisoned, especially during the heat of summer.

Basing his results on microscopical analyses, M. Neuville arranges the waters of Paris in the following order to indicate their degree of purity: 1, waters of the Vanne; 2, of the Marne at Saint-Maur; 3, of the Marne at Charenton; 4, of the Seine at Port-à-l'-Anglais; 5, of the canal of Ourcq; 6, of Arcueil; 7, of the sources of the Nord; 8, of the wells of Passy; 9, of Grenelle; 10, of the Dhuis; 11, of the Seine at the Bridge of Austerlitz; 12, of a well on the left bank; 13, of the Seine at Saint-Ouen; 14, at Auteuil; 15, at Chaillot.—*Science.*

Striæ of the Diatomaceæ.—III.

ON these facts depends the validity of all the deductions which can reasonably be drawn from the constancy of the fineness of the striæ on the large and small frustules belonging to the same species and the same stock. I have spoken of these deductions in the paper entitled "Nuovi argomenti, etc." I have there referred to a very pure gathering which I made near the fountain in the "Fields of Annibal," on Mont Cavo near Rocca di Papa, which was solely composed of myriads of frustules of *Pinnularia stauroneiformis* Sm. var. *latialis*, a variety which I thought myself justified in establishing on the ground of the very great difference in the number of the striæ in the form from Mont Cavo, which was 1,900 to the millimetre, and in the typical form of Smith, which has not more than 1,200 in the same space, a difference which exceeds ⅓, all the other characters remaining absolutely identical. On this occasion I have deduced from the constancy in the form of the striæ on the largest and the smallest frustules in this collection: (1) That at least in this case multiplication did not take place by temnogenesis or division, for, on the hypothesis of the gradual diminution of the valves and frustules, resulting from the encapsulement of the latter, the striæ ought in the same proportion to become finer and finer, if the very explicit opinion of Dr. Wallich is true, viz.: "that the number of striæ in a fractional part of the valve undergoes precisely the same variation as the size of the valve." (2) That the auxesis, the augmentation of the size of the frustules, must take place by the bilateral addition of new striæ, and consecutive dilatation of the bands or zones which unite the valves. (3) That thus the diatom, although invested with a siliceous coat, is the object of a gradual development and distension because the silex is probably found in a combination with cellulose,* in which it replaces the carbon, a substitution the possibility of which is demonstrated by the labors of the chemists, Friedel and Ladenbourg. In support of the second part of this deduction, that is, that in the diatomaceæ the auxesis must take place by bilateral addition of new striæ, and not by perispherical increase as in the crustacea, I refer to another argument. I have pointed out above that in the collections formed of a single species, there are always found large and small frustules, so that the longitudinal axis of some is only the half that of others, or even less. Any one who has examined under the microscope these interesting organisms, not only on the preparations which can be bought, but better still by gathering them himself, and has had the opportunity of obtaining pure gatherings, will find that the cold Alpine sources will frequently have furnished him with very rich and very pure collections of *Odontidium hyemale* Kz. Under these circumstances, in examining one by one the different sizes of the valve on frustules of the same species, if we take the measure of the longitudinal and the transverse axes, we shall see that the dimensions of the former differ considerably, in that some are only the half and even a smaller fraction of the others, whilst on comparing the transverse axes of the valves of these same frustules there is little or no difference. However, no one could deny that the gradual diminution of the frustules which necessarily results from their encapsulement when multiplication by fission takes place, as has been completely demonstrated by Dr. Pfitzer, of Bonn,† ought to produce in the transverse axes the same variation as in the longitudinal.

Urged by the love of truth and by deep conviction, the fruit of long reflection and patient research, I have been induced to explain my mode of regarding the striation of the diatomaceæ, and the value which should be allowed to it in the classification of species, and to indicate the logical conclusions which I have thought ought to be drawn from it. I know that on this point I differ from the predominant opinion and from the ideas of competent persons, whom I otherwise honor, but such is the force of my conviction that I have not hesitated to brave these differences. I retain the hope that these gentlemen, far from regretting my observations, will have the kindness to take them into their serious consideration, and the more so as my opinions on this subject result from the practice which I have invariably employed of drawing the images of the diatomaceæ by means of microphotography, which, applied to all branches of research, in the natural or experimental sciences, cannot fail to render equally useful services.

I think also it will be agreeable and useful to microscopists, particularly to those who study the diatomaceæ, to subjoin a Table of the Measurement and the Number of the Striæ which ornament the surface of the valves in certain species. I have extracted this table from my note-book, in which I put down, each time that I take a measure, the number of striæ corresponding to a millimetre.

As nearly the whole of the types which I have reproduced and examined have been taken from Möller's type-plate, I have adopted the names and the order for the genera as they are employed in the catalogue which accompanies that preparation. I do not, however, wish it to be understood that I approve this order, or that I admit certain modifications in the nomenclature, for instance the inclusion in the genus *Navicula*, already so excessively extended, of all the forms which Ehrenberg and Smith have relegated to the alleged genus *Pinnularia*."

	Longitudinal Striæ per mm.	Transverse Striæ per mm.
Epithemia argus Sm.......	900	1200
" *constricta* Sm...	"	1450
" *zebra* Kz.........	1250	1700
" *gibba* Kz........	"	1600
" *turgida* Kz......	800	900
" *ocellata* Kz. var..	"	430
" *musculus* Kz....	"	1750
" *ventricosa* Kz...	"	1530
" *granulata* Kz....	"	900
" *Hyndmannii* Sm.	670	"
Eunotia undulata Grun....	"	1070
" *tetraodon* Ehb.....	"	1400
" *tetraodon* Ehb. var. *diodon*..........	"	2100
" *tetraodon* Ehb. var. *diadema*.........	"	2400
" *incisa* Greg.......	"	1550
" *indica* Grun......	"	1200
" *prærupta* Ehb....	"	1800
" *Soleirolii* Kz......	"	1200
Synedra thalassiothrix Cleve (Messina)......	"	1370
" *sicula* Castracane.	"	835
" *splendens* Kz......	"	1030
" *ulna* Ehb.........	"	970

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* Mon. Micr. Journ., viii. p. 194.

† Unters. u. Entwickel. Bacill.

	Longitudinal Striæ per mm.	Transverse Striæ per mm.
Synedra formosa Hantzsch.	670	1030
" *crystallina* Kz.	"	1200
" *pulchella* Kz. var.	"	2150
" *tabulata* Kz.	"	1320
" *affinis* Kz.	"	1150
Grammatophora marina Kz. Sm.	1600	1600
" *angulosa* Grun. var.	"	1350
" *oceanica* Ehb.	"	3850
Nitzschia formica Hantzsch	1550	1550
" *linearis* Sm.	"	3000
" *amphioxys* Sm.	"	2000
" *hungarica* Grun.	"	1800
" *sigmoidea* Sm.	"	1070
" *spectabilis* (Ehb.) Sm.	"	2750
" *dubia* Hantzsch.	"	2000
Perrya eximia	"	975
Mastogloia Dansei Thw.	"	1450
" *meleagris* Kz. var.	"	2000
" *Braunii* Grun. var.	"	1850
" *marginulata* Grun. var.	"	1600
" *exigua* Lew.	"	2600
Achnanthes inflata Grun.	"	970
" *subsessilis* Kz.	"	"
" *longipes* Ag.	1400	"
" *brevipes* Ag.	1100	1700
Cymbosira Agardhii Kz.	"	1250
Achnanthidium lanceolatum Breb.	"	1400
Cymbella pisciculus Ehb.	1100	1250
" *heteropleura* Ehb.	"	900-1100
" *affiinis* Kz. var.	"	1200
" *helvetica* Kz.	"	1100-1300
" *scotica* Sm.	"	1150
" *Kamtschatica* Grun.	1200	900
" *navicula* Ehb.	"	1500
" *cuspidata* Kz.	"	1175
Gomphonema robustum Grun.	"	1230
" *acuminatum* Ehb. var. *coronatum.*	"	1100
" *dichotomum* var. *trigibbum,* Eul.	"	1030
" *capitatum* Ehb.	"	1130
" *commune* Rabh.	"	1250
Rhoicosphenia curvata Grun.	"	1670
Navicula ambigua, Ehb.	2609	1900
" *serians* Kz.	"	2200
" *bohemica* Ehb.	"	1700
" *sculpta* Ehb.	"	1450
" *limosa* Kz.	"	1900
" *quinquenodis* Grun	"	"
" *retusa* Breb.	"	650
" *Reinhardtii* Grun.	"	900
" *slesvicencis* Grun.	"	1050
" *sphærophora* Sm.	"	1600
" *amphisbæna* Kz.	"	(little irr.) 1500
" *amphisbæna* Kz. var.	"	1300
" *permagna* Bailey var.	"	1275
" *firma* Kz.	"	1550
Navicula firma var. *affinis* Ehb.	2609	1900
" *firma* var. *amphirhyncus* Ehb.	"	1570
" *firma* var. *dilatata* Ehb.	1650	1650
" *firma* var. *latissima* Ehb.	"	"
" *firma* var. *Hitchcockii* Ehb.	"	2100
" *elegans* Sm.	"	1425
" *crassa* Greg.	"	1250
" *quadrata* Greg.	"	1500
" *entomon* Ehb.	850	900
" *didyma* Kz.	"	1000
" *elliptica* Kz.	"	1325
" *lyra* Ehb.	"	(irreg.) 700–800
" *lyra* var.	"	1000
" *major* Kz.	"	630
" *oblonga* Kz.	"	850
" *gibba* Kz. var.	"	1000
" *hemiptera* Kz. var.	"	1400
" *peregrina* Ehb., Sm.	2400	750
" *viridis* Kz.	2400	720
" *divergens* Sm.	"	(irreg) 1100
" *divergens* Sm. var.	"	"
" *stauroneiformis* Sm.	"	1200
" *stauroneiformis* Sm. var. *latialis*	"	1900
" *crassinervis* Breb.	"	1400
" *rhomboides* Ehb.	1700	2400
Frustulia saxonica Rabh.	3600	3400
Scoliopleura convexa Grun.	3600	700
" *tumida* (Breb.) Rabh.	"	1300
Pleurosigma balticum Sm.	"	1450
" *attenuatum* Sm.	1050	1400
" *hippocampus* Sm.	"	1750
" *formosum* Sm.	1580	1900
" *angulatum* Sm.	"	2080
Donkinia recta (Donk.) Ralfs	"	2100
Toxonidea insignis Donk.	"	2250
Pleurostaurum javanicum Grun.	1300	1320
" *acutum* Rabh. var.	900	1300
Endostaurum crucigerum (Sm.) Breb.	"	1400

Mr. F. Kitton makes the following observations on the preceding paper:—"If I understand the author aright, it would seem that it is only when dealing with a series of valves produced by a single germ or sporangial frustule that the striation is constant and that the variation never exceeds 1-5 in the same species from a different stock. If this means a difference in the number of striæ, the variation is considerable, e.g., it gives a range in *Navicula crassinervis* of 11–14 in ·01 mm.=27–35 in ·001 inch. Some error must have been made in the measurement of the transverse striæ on the above-named species; the author says they are 14 in the ·01 of a mm. (35 in ·001 of an inch), only 2 more than those on *N. Stauroneiformis* Sm., and 10 less than those on *N. rhomboides*, which he says are 24 in ·01 mm., a much easier form to resolve than the form called *N. crassinervis*. *N. limosa* is said to have 19 in ·01 mm., but they are easily resolved with an old Ross ¼ objective (75°). *Endostaurum crucigerum* is also stated to have 14 striæ in ·01 mm.; any ¼ objective easily resolves both the longitudinal and transverse striæ at the same time. *Nitzschia sigmoidea* Sm., the author says, has 10·75 in ·01 mm.; Smith states them to be 85 (=34 in ·01 mm.); Sullivant and Wormely 70 in ·001 of an inch. Professor E. W. Morley[*] makes them 63 (which is, we believe, accurate). *Nitzschia spectabilis* (=*Synedra spectabilis* of Ehrenberg, and *N. sigmoidea* β of Smith), is stated to have striæ as close as 27·50 in ·01 mm. (=68·75 in ·001 of an inch). Smith says they are 42 in ·001 inch; we make them 35 to 38, an average of 14·5 in ·01 of a mm. *N. amphioxys* Smith, 20 in ·01 mm. Castracane; 15 in ·01 mm. Morley. The measurements of Professor Morley were made with great care by means of a Troughton and Sims micrometer belonging to the Hudson equatorial; the objective a Tolles 1-16, and monochromatic sunlight was used; the measurements were afterwards carefully checked by J. E. Smith, of Ashtabula, U. S., by the camera lucida, and they were found to harmonize.

The great discordance in the number of striæ between the two measurements is difficult to understand. We find in

	C.	M.	Difference.
Navicula crassinervis.......	14	33	+ 19
Nitzschia sigmoidea........	10·70	25	+ 14·30
" *amphioxys*........	20	15	— 5
Pleurosigma angulatum.....	20·30	17	— 3·30
Grammatophora marina....	16	14	— 2

This disparity can only be accounted for either by supposing that different forms had been measured, or that one of the systems adopted was not to be depended upon. The former supposition seems the more probable, as some of the measurements agree, or nearly so; e.g. *G. marina* and *Pleurosigma balticum*, C. 14·5, M. 14 nearly. Dr. Woodward[†] says the number of striæ on *Frustulia saxonica* is 85–90 in ·001 of an inch (34–36 in ·01 mm.); Count Castracane makes them 34 in ·01 mm.

Dr. Schumann, in his 'Diatomeen der Hohen Tatra,' says he found *Navicula rhomboides* with striæ as close as 78 in 1-100 Paris line; this is equivalent to 87¾ in ·001 of an inch, or 35¼ in ·01 mm. These numbers agree very well with those on *F. saxonica*."—*Jour. Royal Mic. Soc.*

Rhythm of Handwriting.

DR. J. H. WYTHE, of San Francisco, "maintains that every man's handwriting is infallibly distinguished by three characteristics, that may be detected by the microscope while they escape the eye, which he calls the rhythm of form, dependent on habit or organization; the rhythm of progress, or the involuntary rhythm, seen as a wavy line or irregular margin of the letters; and the rhythm of pressure, or alternation of light and dark strokes. The proper microscopic examination of these three rhythms, under a sufficient illumination of the letters, cannot fail, he believes, to demonstrate the difference between a genuine and an imitated signature."

The Doctor's theory we believe to be sound; but we would prefer to more simply define the "three characteristics," as habit of form, movement, and shade; these, in connection with other attendant peculiarities of handwriting, furnish a basis sufficient to enable a skilful examiner of writing to demonstrate the identity of any handwriting with a great degree of certainty.

In extreme cases, and especially skilfully forged signatures, the aid of the microscope will be necessary for a proper examination, but for the greater proportion of cases of questioned handwriting a common glass, magnifying from ten to twenty diameters, will serve much the better purpose, as it is ample to reveal the characteristics of the writing, while its greater convenience of use and broader field of view are greatly in its favor.

In the writing of every adult are habits of form, movement, and shade, so multitudinous as in the main to be unnoted by the writer, and impossible of perception by any imitator. Hence, in cases of forged or imitated writing, the forger labors under two insuperable difficulties, viz.: the incorporation of all the habitual characteristics of the writing he would simulate, and the avoidance of all his own unconscious writing habit, to do which in any extended writing we believe to be utterly impossible.

How far this inevitable failure may be discovered and demonstrated depends upon the skill of the forger, and the acuteness of the expert.—*Prof. D. T. Ames, in Penman's Art Journal.*

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[*] Mon. Micr. Journ., xv. (1876) p. 227.

[†] 'Lens,' i. p. 233.

Thermal Death-Point of Bacteria.

THIS subject deserves careful attention in view of its relation to disease germs and parasites. We take from the *Journal of the Royal Microscopical Society* the following notes, contributed by Cohn to the *Bull. Soc. Bot. de France*:—

Cohn has assigned 55° C. as the highest limit of temperature at which the bacteria he studied, and notably bacilli, still lived and developed. This temperature is, in fact, M. P. van Tieghem says, fatal to most of these organisms. Nevertheless, he last summer observed several which developed rapidly and formed their spores regularly, at the considerably higher temperatures of 60°, 65°, 70°, and up to 74°. In a d'Arsonval apparatus, regulated at the latter temperature, several successive growths of two of the organisms were obtained.

One was a *Micrococcus* whose spherical cells were arranged in long chaplets, the "beads" measuring 0·0015 mm. They developed throughout the nutritive fluid, which they rendered uniformly turbid. The other was a *Bacillus* with very pale joints, always stationary, spreading over the surface in a thin mucous pellicle. Its cells disunited immediately after their division and placed themselves parallel to each other, thus forming long palisade-like series in which the "battens" were bound together by a gelatinous substance. They formed their spores rapidly, and disappeared, leaving those spores arranged side by side in transverse series as they themselves had been.

In these cultures an infusion of kidney-beans or broad-beans, filtered and perfectly neutralized, was the nutritive fluid employed. It was first heated in the stove to 74°, and the sowing made on the spot. Thus the objection cannot be raised that the development observed could, at least in part, have taken place during the time consumed in heating the liquid. It is also necessary that the latter should be and remain neutral. Should it be slightly acid all development will soon cease. This explains the fact that, under these conditions, the development of the two organisms only took place during the first two or three days after the sowing; later on the fluid again became clear, and thenceforth sterile. A certain amount of acidity produced by the organism itself is then always observable, which soon renders the fluid uninhabitable by it. Moreover, the *Bacillus* quickly produced its spores, which were set at liberty after the end of the second day.

At the temperature of 77° the development of the *Bacillus* no longer took place, and fluids sown with its spores preserved their clearness.

In conclusion, M. P. van Tieghem mentions that he is induced to publish these observations by the remarks of M. P. Miquel* of the existence in ordinary water, especially in that of the Seine, of an immobile and filamentous *Bacillus* that "readily supported a temperature of 60° to 70°," and, cultivated in a neutralized meat infusion at 69° to 70°, "produced filaments, pellicles, and spores, the luxuriance of whose vegetation and fecundity left nothing to be desired." At 71° to 72° this *Bacillus* died. "It is curious," observed M. Miquel, "to see an organism living and swarming in a liquid in which the hand is scalded in a few seconds."

The two species observed by the author passed this limit, and it is possible others may yet be found capable of developing at still higher temperatures.

Preparing Coal Sections.

PROFESSOR P. F. REINSCH gives the following directions for preparing sections of coal:—

A plane cut, as in rock and mineral sections, generally is not serviceable; the cut must be made in relief. Thus only the different forms can be brought out, as according to their hardness each form will become more or less transparent, since the softest parts will be worn faster, and hence be finally thinner and more transparent than the more resisting forms. Sections parallel to the bedding are made without difficulty; not so sections at right angle. Much precaution is to be exerted with these. Cut the raw plate with a steel saw 4 mm. thick, 15 mm. square. Make a plane cut as usually in rock sections, but using only the finest emery (polishing emery) or precipitated carbonate of calcium. Then rub the surface gently in all directions with a cork plate (perfectly soft and no grains) 10 mm. square, and moistened with a drop of glycerine. This treatment produces the relief. Frequent examinations must be made under the microscope, to observe the point where the desired transparency has been reached (not less than 0·01 mm.) In some cases, as for trichites and grammites, it is best to warm the raw plate and saturate it with a mixture of wax and paraffin. When attaching the plate to the support, it should neither be heated too long with the balsam nor too short a time, the first excess causing the plate to warp, crack, and inducing a partial alteration of some of the coal constituents; too little boiling causes the plate to detach itself from the support during the process of grinding. Chemical treatment with acids or alkalies is not advisable.—*American Naturalist.*

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* 'Annuaire de l'Observatoire de Montsouris pour 1881 (Meteorologie),' p. 464.

◆

Effect of Sewage on Oysters.

DR. CAMERON, in the Dublin *Journal of Medical Science*, points out the fact that the bivalves taken from beds in the vicinity of rivers, or adjacent to large towns on the coast, are liable to contamination by sewage. These mollusks, with crabs, lobsters, and the like, are indeed the scavengers of the shores, and though in the crustaceans we may have to swallow a lot of miscellaneous offal, we at least have the privilege of having it cooked, while in the oyster we generally take it raw. Microscopical examination of the liquid taken from oysters from Clontarf showed it to swarm with micrococci and other low organisms, similar to those present in ordinary sewage.

This is a new direction in which our microscopists may find use for their instruments; and the effect of these low forms of animal and vegetable life upon the growth and development of the oyster is well worthy of investigation. Oyster eaters need not be alarmed, however. There are very few of these low organisms that are dangerous when taken into a healthy stomach. It would be interesting to inquire how far the oyster acts as a disseminator of noxious parasites.

◆

The Battle of the Stands.

IT has hardly yet been generally recognized that the old battle between the "Jackson model" and the "Ross model" is virtually at an end, in consequence of a discovery which had not been made when the question originally arose.

The advantage of the Jackson model was the increased steadiness which was obtained by the support given to the body-tube throughout the greater part of its length, a support which was wanting in the Ross model.

The advantage of the Ross model consisted in the greater efficacy of the fine adjustment, which could be worked by a relatively long lever, instead of being confined, as in the Jackson model, to a very short one in front of the lower end of the body-tube.

The invention of the method of fine adjustment by which the whole of the body-tube is moved, and not merely an inner tube, carrying the objective at the end of the body, at once deprived the Ross model of the advantage which it previously possessed, and left the Jackson model necessarily the preferable form.*

The Ross model is no longer made by the firm whose name it bears, but it has in its day enjoyed so much celebrity that, in order to record it for future reference, we print here a figure of it (Fig. 177) which has not previously appeared in the pages of this journal or its predecessors, other than in the advertisement covers, which are but rarely bound up.—*Jour. R. M. Soc.*

[This figure is given as one of the plates in "How to Use the Microscope."—ED. AM. JOUR. MICROSCOPY.]

◆

The Vitality of Germs of the Artemia Salina and of the Blepharisma Lateritia.

BY A. CERTES.

THE sudden appearance of certain inferior crustaceans (Apus, Branchipus), after inundations or heavy rains, has already been recorded on several occasions, and it has been rightly supposed that the eggs of these crustaceans had the property of remaining uninjured notwithstanding great changes in the conditions in which they are placed. A recent experience, with *Artemia Salina*, leaves no doubt on this point, and demonstrates that the alternatives of drouth and moisture, to which the eggs of this crustacean may be subjected, may be prolonged for several years.

In March, 1878, I collected, near Boutinelli (province of Constantine, Algeria), saline water from the Pit of Timrit.

A rapid examination, the only one possible at the time, permitted me to note the existence of algæ, infusoria, and even of larvæ, of which I could not then determine the species. I evaporated the water in the sun, and I collected the sediment with care, with a view to experiments in revivification, which, seemed to me, ought to be more convincing with waters of a special chemical composition than with either fresh or brackish water.

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* Dr. Carpenter "feels assured that the principle of supporting the body along a great part of its length (which may be applied in a variety of modes) will in time supersede that of fixing it by its base alone, which is obviously the mode *least* adapted to prevent vibration at its ocular end."—'The Microscope,' etc., 6th ed., 1881.

On the 9th of April, 1881, that is to say, after more than three years of complete desiccation, these sediments have been replaced in rain water, boiled and filtered, which rapidly became strongly saline. After the following day, notwithstanding all the precautions that had been taken to keep this infusion free from screened germs, I found in it flagellate, and, shortly after. ciliated infusoria, which, I ought to say, from the species recognized, did not give to the fauna a special character. It was only at the beginning of June that I perceived the presence of swimming larvæ, at first microscopic. Since then the number of these larvæ has greatly increased. They have become large and transformed into an animalcule nearly 0m. 01 long, furnished with a tail, and moving actively by means of its branchial feet. Even to-day (October 31) I possess several living samples. M. Vayssière, who has kindly determined the species of these animalcules, recognizes among them the *Artemia Salina.*

As far back as 1875, Schmankewitsch had remarked the curious modifications which the organization of this minute branchipod crustacean undergoes, according to the degree of saltness of the water in which it lives. On my own part, even before I was able to determine the species with which I was experimenting, I had transported, in sea water, a certain number of *Artemia,* which live there yet. Up to the present time I have not remarked any other modification than their extreme transparency, due, without doubt, to the change of nourishment.

The presence of *Artemia Salina* has already been noted, according to Claus, in the salt marshes in the environs of Montpelier, of Cagliari, of Lymington, and in the Crimea. M. Vayssière has found them near Marseilles. They have not yet been remarked in the pits of Algeria, in which the periods of desiccation are certainly more warm, more prolonged, and more frequent than in the localities of which I have just spoken. In whatever way these revivescent germs, eggs, or animals behave, it is evident that the phenomena of latent vitality is at the bottom of the whole. In these various instances, death is only apparent. The phenomena of organic combustion and the nutritive changes never completely cease in living bodies—eggs, grains, or animals. I do not wander, therefore, from my subject when I note another fact which I have had occasion to observe in Algeria in regard to *Blepharisma Lateritia,* a ciliated infusorion which is relatively quite rare.

The Sahel of Algiers is overlooked by a small mountain, the Bouzaréah, at the summit of which exist the moats of an old Turkish fort. In 1877 the drouth had been exceptional, even in the Sahel. After the first rains I climbed the Bouzaréah, and, in the same moat in which I had gathered them eight months previously, I found an abundance of *Blepharisma,* very sharply characterized by their form and by their rose color. In this case also, during an excessive heat, they had maintained a latent vitality, either as animalcules, as germs, or as cysts.

I have still in my possession a number of sediments obtained from widely different localities. I intend to continue my investigations during the coming spring.—*Journal de Micrographie.*

◆

—The old globe condenser, which consists of a glass globe filled with water, and used to condense the rays of a lamp or candle on an object, has been lately recommended very strongly by an English writer. One of the objections made to it is that it cannot be adjusted as to height, etc., but this difficulty is avoided in a very simple manner by means of a little device described in a recent number of the *Young Scientist.*

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Those who wish to have their numbers bound, can do so for 35 cents per volume. Mailing 15 cents additional.

FOREIGN SUBSCRIBERS.—Subscribers in Great Britain and the Continent of Europe will be supplied at the rate of $1.20, or 5 shillings sterling per year, postage paid.

Remittances may be made either by P. O. Order, check on a London Bank, or in British postage stamps.

The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Another very extensive advertiser says: "We have advertised in several other journals, but have obtained more results from yours than from all the others put together."

Postage Stamps.

WE again call the attention of our subscribers to the fact, that while we take postage stamps of small denominations at full value, those of higher denominations are of no use whatever to us. We cannot sell them, except at a very great loss, and the post office will not exchange them for smaller denominations. Therefore, please do not send them.

The French Edition of Habirshaw's Catalogue.

M. PELLETAN, Editor of the *Journa de Micrographie*, announces, in a recent issue, the immediate publication of the French edition of the "Catalogue of Diatoms," by Mr. Fred. Habirshaw, of this city. This catalogue gives the names and synonyms of all known diatoms, and also references to the books and journals in which they are described, and as the names are almost all in Latin, it matters but little in what language the work is published. Moreover, the titles of English books and journals are given in English; those of French, in the French language; those of German, in German; and this must necessarily be the case, no matter in what country the work is published.

That the publication of this work will not prove a very profitable undertaking there is no doubt; and M. Pelletan gives as a partial reason for the delay the fact that, as soon as he undertook the publication of the catalogue, Mr. Habirshaw saddled him with such a list of complimentary copies as included nearly all the diatomists who would be likely to be purchasers, the consequence of which was that the work could not be issued except with the certainty of heavy pecuniary loss.

The misunderstanding in regard to this matter is greatly to be regretted. We feel that if Mr. Habirshaw had been properly informed in regard to the financial effect of so many free copies, he would have gladly modified his request; and that if Dr. Pelletan had fully understood Mr. Habirshaw, he need have had no hesitation in freely placing the matter before him.

But whatever the personal effect of this misunderstanding may be, microscopists in general can only gain by the speedy publication of the catalogue, which will now be pushed forward, be the subscriptions few or many. The price has been placed at 15 francs per part for all places within the postal union, but we are not informed as to the number of parts that the work will probably make. We have, through the kindness of Mr. Habirshaw, a copy of the first edition, of which fifty copies only were issued. We understand, however, that the second edition has been greatly enlarged, both in the list of Diatoms and in the bibliographical portion.

Correspondence.

The Editor of the American Journal of Microscopy does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Optical Effect of Slits.

Ed. Am. Jour. Microscopy—Having had occasion to show that the obscuration of lines viewed through a slit is not the result of *dimness* merely, I adopted the following simple plan, which may interest your readers in these days of diffraction studies.

The method may not be novel, but I have never seen it recorded.

Choose a window sash which faces the sky, or some bright object of nearly uniform tint, and look at the sash through a slit held in various positions.

While the slit is vertical the vertical bars of the sash will seem hazy, but the horizontal bars sharply defined. If an adjustable slit—made on the parallel rule pattern—is used, the vertical bars may be made to disappear, almost, while the horizontal bars still show distinctly. By turning the slit into a horizontal position, the vertical bars become definite and the horizontal ones hazy.

This is all in accordance with theory, of course, and very simple, but interesting nevertheless.

Instead of the sash one can use as object a plus sign, marked with very black pigment on white paper, or with chalk on a blackboard.

F. C. Van Dyck.

Rutger's College, New Brunswick, N. J., Jan. 26, 1882.

Current Notes.

Medium for Increasing Visibility.—Prof. Abbe recommends mono-bromide of naphthaline for mounting diatoms as less inconvenient than the solutions of phosphorus or sulphur in bisulphide of carbon. The liquid is colorless and oleaginous with the odor of naphthaline. It is soluble in alcohol and ether, and has a density of 1·555, with a refractive index of 1·658, giving, therefore, as the "index of visibility," 22, as against 11 for Canada balsam. It is not volatile. The cover glass should be run round with a ring of wax; then a cement of isinglass dissolved in spirit or Canada balsam, rather thick, dissolved in chloroform; finally closing with a solution of shellac.

Vinegar as a Preservative Fluid.—At a recent meeting of the Quekett Club, the president, T. Charteris White, Esq., stated that he had tried a great many things for the purpose of preserving the green matter or endochrome of desmids, but that all the various mixtures he had used had been found to fail, except the water in which the desmids were found. Some time ago he saw a suggestion in the "*Royal Microscopical Journal*" that pickling vinegar had been used with success, and he had given it a trial and found that up to the present time it had not disturbed the endochrome, but it appeared to have changed the color to that peculiar green which was commonly observed in pickles.

The Flagellum of the Micrococcus.—Mr. E M. Nelson has communicated to the Quekett Club the fact that while studying a slide of various kinds of bacteria and micrococci, stained with methyl violet and mounted in Canada balsam, he found that some of the *micrococci* had a flagellum. He first observed this with a 1-25th oil immersion objective by Messrs. Powell & Lealand. Mr. W. Watson Cheyne had verified these results.

Modifications Produced by Change in Condition.—Carl Semper, in his recently published work on "Animal Life," mentions a fact in illustration of the modifications of character producible by varying the conditions under which develment takes place. The fresh-water crustacean *Branchipus stagnalis*, is remarkably like the *Artemia salina*, nevertheless the differences between them have always seemed sufficiently conspicuous to justify their separation into two different genera. *Artemia salina* was kept in salt water, which was constantly being diluted by the addition of fresh water till it had become perfectly fresh. The Artemia, the meanwhile, breeding, at the end of several generations, had so gradually and completely changed their characters, that finally they had acquired those of the genus *Branchipus*.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the Transactions of any of our Microscopical Societies. The limited space at our command precludes the insertion ot lengthened accounts of mere business details. We wish it also to be distinctly understood that these reports are published as received from the Secretaries of the different Societies, and the Journal is not to be held in any wise responsible for any statements contained therein.

Report of the Committee on Exhibition, of the Biological and Microscopical Section of the Academy of Natural Sciences of Philadelphia.

Mr. Director and Gentlemen:—Your committee have the honor to report that in accordance with the resolution passed by the Section on the 3rd of Oct., 1881, an exhibition of microscopes and microscopical apparatus was held on the evenings of November 16th and 17th, in the hall of the Academy, which was, as usual, largely attended. On the evening of the 17th it was formally opened by the Director, Dr. Robert S. Kenderdine, who introduced the Rev. Dr. McCook, by whom a short and appropriate address of welcome was delivered, indicating the object of the display, and directing the attention of the guests to the most striking and novel exhibits. On the first evening 116 microscopes were shown, and on the second 153 instruments were on the tables.

Of these, 14 were brought by the Microscopical Society of West Chester, 10 by the Philosophical Society, of the same place; 13 by the Camden Society, and two were "projecting-lantern-microscopes" for class demonstration.

Of the improvements in the means of microscopical research we would especially notice, as shown by Mr. Zentmayer, a new triple nose-piece, made of but two pieces of metal instead of six, thus giving greater lightness, strength, and accuracy of adjustment; a peculiar and especially compact and secure mode of packing the Student stand for travelling: an addition of a lengthening bar to the mirror of the Histological stand, giving greater facility for illumination; and a graduated circle for regulating oblique illumination, recently added to the Army Hospital stand.

Messrs. Queen & Co. exhibited an objective by Zeiss, with adjusting collar, whereby the focus can be instantly altered to any point between 2 and 5 inches. It possesses good defining and penetrating powers, with a large and flat field of 1½ inches at its longest focus, and ⅜ inch at its shortest, and is especially adapted to the examination of opaque objects.

They also showed a spiral diaphragm for oblique illumination; a Wenham immersion lens for lighting wide-angle objectives, focussing the illuminating rays upon the object a colorless marine glue, giving a brilliant transparent finish to mounts, and which may also be used as a mounting medium; a glass-cutting attachment to the centering turn-table; and a pocket microscope made by Zeiss, in a "polished mahogany box," about 1½ inches long, with a screw focal adjustment, giving a power of about 150 diameters, and which is particularly useful in field work, with transparent objects. Perhaps the most valuable addition to the microscopist's armamentarium which this firm exhibited was an exceedingly compact dissecting microscope, giving good working surface and rack adjustment, and folding into a flat box that can be easily carried in the pocket. They also showed a convenient compressorium and trichinascope made by Bausch & Lomb; an inexpensive cabinet to contain 400 slides; and a line of "Acme" microscopes, which last-mentioned instruments, in the opinion of the committee, failed to maintain the desirable standard of workmanship.

Mr. Walmsley exhibited, for R. & J. Beck, an improved National microscope, with sub-stage moved by rack and pinion, a centering stop for the bar carrying sub-stage and mirror, which bar will carry the mirror above the stage, and having the nose-piece removable, leaving the screw on the lower end of the body open, the thread of which is of the Butterfield or broad-gauge type, and suited to objectives of the widest angle. The fine adjustment is removed to the rear of the arm. A new shutter diaphragm was also shown by this firm.

Both the Acme Optical Works and Messrs. R. & J. Beck exhibited Lithological microscopes especially intended for mineralogical work, with graduated collar for polarizer, pivoted immediately beneath the stage, and carrying lenses for concentration of light; the analyzer also is adjustable by a graduated circle. They are fitted with a Klein's Quartz plate a Stauroscopic plate, and the nose-piece is removable, freeing the broad-gauge screw on the lower end of the body for the reception of wide-angle objectives. Delicate lines for centering are placed in the eye-piece; and the Acme stand carries an analyzing prism above the objective, in the body of the instrument, which can be slipped out when using the eye-piece analyzer. The Beck instrument has milled-heads on the nose-piece for centering the objective.

Two of the "Holman Projecting Lantern Microscopes," made by Mr. Zentmayer, were exhibited. This instrument consists of the ordinary lantern and gas microscope, elegantly and substantially mounted in brass, with rack adjustments, giving universal motion around the optical centre, as in the Zentmayer Centennial Microscope. It is capable of being used also as a megascope and table microscope. While this instrument is unrivalled in workmanship and completeness of detail, it involves great weight, lack of stiffness, and difficulty in accurate centering.

An ingenious and inexpensive combination of odd pieces of apparatus was exhibited by Prof. F. L. Scribner, with which a vast amount of difficult botanical work has been accomplished, and many fine drawings mad with the camera lucida.

Your committeee noted this year a marked increase in the number of working microscopists, and a great advance in technical skill, thus giving, by reflected light, better definition to the Section itself; and they feel that the Section is to be heartily congratulated upon this improvement; nevertheless they would remark that while the illumination of the microscopes was in many instances all that could be desired, there were a large number of instruments in which more care in the manipulation of the light would have produced vastly better results.

The following is as complete a list as we can obtain of the exhibitors and of the objects shown:

By Wm. H. Walmsley.—(Polariscopic) Salicin, Amygdalin, injected Toe of White Mouse. (With Paraboloid) Sphagnum, bleached; Diatoms. (Opaque) Pollen of Abelmoschus, Curculio from Brazil, Young Oysters, Malachite. (By Transmitted Light) Wolfia Columbiana, trans. section of Human Tongue, injected; Cerebrum and Cerebellum of Cat, full-sized sect., injected; fine Langenheim Photograph, Leaf of Nymphea Dentata, double stained, showing internal hairs; Blood of Frog and Toad, very fine specimens of double staining; Head of Tabanus, Quartz plate on Lithological stand.

By Prof. F. L. Scribner.—Dissections of Grasses, with drawings and microscopical apparatus.

By Mr. Zentmayer.—Small Garnets from Virginia, prepared by Dr. J. G. Hunt. Quartz Crystals from Mica, Plumose Crystals of Red Ox. Copper (native), prepared by Geo. W. Hiss. Native Crystals of Copper, prepared by Geo. W. Hiss and Miss Rakestraw (the above are believed to be entirely new objects). Also Pollen of Portulacca, prepared by Geo. W. Hiss. Tongue of Kitten, prepared by Chas. Zentmayer. Arachnoidiscus Japonicus, prepared by Dr. J. G. Hunt. Arranged Diatoms, prepared by C. Haliger. Lip of Rabbit (inject.), prepared by Bicknell. Leaf of Drosera rotundifolia, prepared by Dr. J. G. Hunt. Anatomy of Mosquito, prepared by Bourgone. Isthmia Nervosa, prepared by Bicknell. Crystals of Uric ac., Tartaric ac., and Red Prus. Potassa.

By Jas. W. Queen & Co.—Diamond Writing on Glass, Double Stained Vegetable Objects, Butterfly's Wing, Potato Bug, Humming Bird's Feathers, Platino Cyanide of Yttrium, Spirogyra in Conjugation (a very fine specimen), Eozoon Canadense, Gold Crystals, Unicellular Plants, Seaweeds, Plant Seeds, etc.

This firm also showed a recent edition (the 6th) of Dr. Carpenter's "Microscope and Its Revelations," and a new work entitled "Pond's and Ditches," by Cooke. W. Mitchell McAllister displayed: Ovary of Sarracenia Purpurea, Ovary of Poppy, Transverse Section of Ricinus (all three very choice), Leaf of Fuchsia, Leaf of Euphorbia, Spores of Adiantum Pedatum, Crystals of Copper, Shells and Sand from Bermuda, Elytron of Diamond Beetle, Tongue of Kitten,

The West Chester Microscopical Society exhibited as follows: Dr. Jackson, Young Snails. Mr. Sharpless, Sporangia of Botrychium. Dr. Eldridge, Wing of Diamond Beetle. Mr. Wm. Hall, Dodder, parasitic on Impatiens. Prof. Rothrock, Dotted Vessels in Malva, and trans. section of Clematis. Mr. Wm. Jeffries, Quartz Crystals, Native Gold, and Copper. Mr. Addison May, Ramalina, a lichen. Dr. J. B. Wood, trans. section of Cytissus. Mr. J. H. Thorne, Cyclosis in Closterium. Dr. Jesse Green, Native Copper. Mr. Alfred Sharpless, Crystals of Navellitt. Mr. Eusebius Townsend, Tongue of Snout Fly.

The West Chester Philosophical Society exhibited: Antenna of Melolontha Vulgaris, Larva of the Caddis, Thrips Cerealium, Aphis from Rose leaf, Pentatoma (tricolored), Maple Aphis, Larva of the Staphylinus, Peziza œruginosa, Larva of Gad Fly on horse-hair, Fertilized sect. of Ovary of Tulip, Egg of Cirvex Sectularia, Sections of Human Intestine (injected), Section of Glandular Stomach of Owl, Flower of Sweet Alysum, Polyporus Sanguineus.

The Camden Microscopical Society exhibited: A. P. Brown, Foot of Spider. Wm. J. H. Morrison, Hydra. H. E. Fortimer, Salicin. Chas. Bowden, Cheese Mites. W. D. Clarke, Pulex Felis. R. Bingham, Head of Beetle. C. H. Hain, Vorticelli and Arranged Diatoms, the latter being very beautiful specimens of his own work. Mr. A. W. Vail, a very beautiful specimen of Areinmia Mexicana. L. T. Derousse, Parasite of Monkey. E. P. Alexander, Acarus. C. M. Forbes, Parasite of Fly. Isaac C. Martindale, Cyclosis in Anacharis.

Dr. J. G. Hunt showed Tubularia Indivisa, Pistillidia of Mosses and Liverworts, Crystals of Hematin from Human Blood, Tessellated Epithelium from the Amphium Tridactyla, and Gonidia of Lichen, *in situ*. It is only necessary to record the name of this exhibitor to indicate the beauty and perfection of his work.

Mr. Ryder, of the U. S. Fish Commission, made a most instructive and unique display of the intracellular network in the connective cells of the oyster, stained with rose naphthaline. .

Dr. Chas. S. Turnbull exhibited the following rare slides, beautifully mounted, under 13 microscopes: Lymph Spaces and Nerves of the Cornea, sections of Cornea and Iris of Elephant, Epithelium, Endothelium, and Corneal Corpuscles, sections treated with chloride of gold and nitrate of silver to illustrate inflammatory action; Eye of Chicken on the 3d and 4th day, showing development of Cornea and Crystalline Lens; minute anatomy of Retina, etc.

Dr. Robert J. Hess exhibited six microscopes, with interesting pathological specimens, among which were, the Tubercle of Lung, Engorged Lung, Lung in acute catarrhal pneumonia, section of Human Spinal Cord, and a slide of Diatoms.

Dr. Geo. A. Rex exhibited a choice collection of Fungi and Opaque Objects.

Mr. Hüttinger also showed an interesting collection of Fungi, among which was a beautiful specimen of Hemicareyria.

Dr. A. G. Reed presented some unique Florescent Crystals of Gold and Silver, and Crystals of Copper (all native), and a rare specimen of the Polyp Cordolophora Lacustris.

Dr. Hollingsworth exhibited Artificial Crystals of Gold and Silver.

Dr. J. Ashley Faught exhibited beautifully stained and injected section, showing the eruption of the teeth.

Prof. J. A. Remington showed fine Crystalline Pharmaceutical Slides with the polariscope; and his assistant, Miss Babb, exhibited a large and beautiful set of sections of Pharmaceutical Woods, prepared by herself. These, in some cases, yield the only means of recognizing certain varieties of drugs.

Dr. Shaffner showed a Moth's Wing, Proboscis of a Mosquito and Eye of Fly.

Dr. L B. Hall showed Rhinoceros Horn, and Marine Algæ in Fruit.

G. E. Hill showed Arachnoidiscus.

Chas. P. Perot exhibited Crystalella.

J. F. Herbert, section of Eyelid.

J. S. Cheyney, Anatomical Preparations and Polar. Crystals.

Dr. Willard had a beautiful specimen of double stained Frog's Blood Corpuscles.

Dr. Kirkbride, Arsenious ac., Synapta and Chirodota, with Parabola.

Prof. H. C. Lewis exhibited Living Infusoria and some rare Polarizing Minerals, for Mr. Rand.

Uselma C. Smith showed Living Objects.

H. Hill showed the Eye of a Fly.

Dr. J. P. C. Griffith showed Ciliated Epithelium, Globus Major, Pedunculated Hydatid of Morgagni, Fresh-water Algæ, and Fern Leaf.

Wm. C. Stevenson exhibited Mycological Preparations.

Wm. Trimble exhibited the Cyclosis in Chara and Nitella.

Dr. Schäffer showed Muriform Tissue from Fern, and the Stellate Hairs on Sida Lepidata.

Jos. Schimmel exhibited a Rotating Disc, containing Spikelets and Flowers representing 30 species of Grasses and Sedges.

J. C. Wilson showed Baltic Mud, and Polarizing Crystals.

J. S. Walton showed Isthmia Nervosa.

Drs. W. W. Keen and C. S. Boker kindly loaned their microscopes for the Section's use, as did also Messrs. G. W. Hiss, W. W. Goodwin, and G. H. Perkins.

D. S. Holman showed Circulation of Blood, and Projecting Lanterns, for Messrs. Geo. H. Perkins and Henry Bower.

Jos. Baird, Dero and Pectinatella.

Dr. C. N. Pierce exhibited Anchors of Synapta.

Dr. E. C. Hine, the Tongue of a Puppy.

Dr. S. C. McClure, Intestine of Cat, injected Kidney of Cat, sections of Retina and Cornea.

Chas. Bullock showed the Skin of Hippopotamus.

Dr. Isaac Norris displayed Thionurate of Ammonia, and Möller's Diatoms.

Dr. Piersol exhibited section of Optic Nerve Entrance, Corneal Nerves and Corpuscles, and section of Spinal Cord.

H. S. Hitchcock exhibited Injections and Botanical Sections.

Edward Potts exhibited a variety of Freshwater Polyps.

Galloway C. Morris exhibited the Sensitive Hairs from a Cat's Whiskers.

Geo. A. Binder exhibited Floating Heart and Living Animalculæ, Elytron of Beetle, Raphides of Tradescantia.

Miss Gertrude Kenderdine exhibited an unusually fine Photograph.

Dr. R. S. Kenderdine showed a variety of Botanical Preparations, among which was a beautiful specimen of double staining of a section of the India-rubber Plant.

The committee take this opportunity of expressing their high appreciation of the handsome displays made by our sister societies of Camden and West Chester, as well as by many of our friends resident in the city and vicinity, which so signally increased the interest of the exhibition. They also would especially acknowledge the courtesy of the Entomological Section in opening its cases, and preparing the very elegant display which constituted one of the most attractive features of the evening; and they would most respectfully suggest to the Academy that, in future exhibitions, the museum of the Academy be opened to the public as one of the most important attractions which it possesses. It has usually been thrown open upon similar occasions in the past, and its closure was the source of universal regret at the recent exhibition, and your committee believe that its display would involve no peculiar risk to either the museum or its visitors.

As much opposition was encountered, from those exhibiting, to the continuance of the display for two nights, the committee would ask all interested to consider for a moment the very great advantage which all derive from this feature, and none more than the exhibitors themselves, by the distribution of the throng of visitors over two evenings, instead of throwing the whole mass into one; and we are tempted to recommend for the future even a further extension of the time of exhibition, with a strict limitation of the number of visitors to be admitted on each evening.

A strenuous effort was made to reduce the exhibits to something like methodical arrangement, with what poor success was evident to all; and it is suggested that, in the future, a more accurate distribution of work among the members of the committee might lessen confusion and facilitate the inspection of the instruments.

It may be as well to mention that out of 150 circulars sent out with enclosed postal cards to be returned, stating whether the party addressed would exhibit or not, only 48 were heard from.

The total expenses of the Section were $60.85.

All of which is respectfully submitted.

Chas. Schaffer,
W. Mitchell McAllister,
Chas. P. Perot,
Samuel L. Fox,
A. L. Reed, M.D.,
Robt. J. Hess, M.D.,
Charles Zentmayer,
Isaac Norris, M.D.,
W. H. Walmsley,
Committee on Exhibition.

State Microscopical Society of Illinois.—The regular meeting of this Society was held at the Academy of Sciences, No. 263 Wabash Avenue, on Friday evening, Dec. 9th, 1881, President Dr. Lester Curtis in the chair. After the reading of minutes and other routine business, the Secretary announced the following donations:

From Dr. Schmidt, of New Orleans, one doz. slides, consisting of nerve fibres and other histological preparations; "Botanical Notes," from Prof. E. J. Hill, of Englewood, Ill.; Bulletin of Microscopical Society of Belgium, and the Report of the Microscopical Society of Liverpool; Dr. Angier, of St. Madison, Iowa, spoke in reference to some acari which he had found under the skin of a chicken. Prof. Burrill, of Champaign University, was introduced, and spoke in reference to the poison of the poison ivy. He took some of the exudation and found it teeming with bacteria, and he questioned whether the poison and the bacteria came from the plant or otherwise. The speaker stated that, upon examination of the washings of the leaves, he found the same forms; the milky fluid which exuded from the stem contained numbers of them, and the effect of placing some of this upon his arm had been attended with quite serious results. The speaker went on to say that he had found the foregoing facts true with other plants, among which he mentioned the chicory, buckwheat, and dandelion.

Dr. Curtis described a new half-inch objective, made by Gundlach, and owned by Dr. J. Hollist. The glass was claimed by the maker to have an angle of 100°. Its angle had not been measured since leaving his hands. It has the society screw, and can be used on any ordinary stand. The back lens of the objective is large and extends beyond the border of the opening in the screw. This opening, therefore, acts as a diaphragm. In order to secure the benefit of the full aperture, this portion of the objective can be removed and an adapter, furnished with the Butterfield broad-gauge screw, can be substituted. It has also another screw of about the same diameter as the Butterfield screw, but provided with a finer thread. The name and description of this screw was not known. The front of the objective is ground down to a conical shape. For ordinary use this front is covered with a brass cage having an aperture in the centre to allow the conical end of the objective to pass through. The cap can be removed when it is desired to use the objective for the examination of opaque objects. On removal of the cap, the conical sides of the lens are seen to be covered with some sort of black varnish, to prevent the passage of outside light. A Lieberkuhn is furnished with the glass, which can be screwed on in place of the cap while examining opaque objects. The speaker had not had the glass in his hands long enough to become perfectly acquainted with all its qualities. It certainly is a good one, however. It resolves angulatum very satisfactorily, and bears eye-piecing extremely well, working admirably on anatomical structures. The Lieberkuhn seems to be a valuble addition for some sorts of study, as it brings out surface markings with unusual clearness, even in transparent objects.

Mr. E. B. Stuart exhibited a Hitchcock lamp, which he stated commended itself to the use of microscopists. No chimney is required, it being a blast lamp, the flame of which is fanned by a passage of air from the bottom to the top of the lamp, driven by a noiseless clockwork. The oil well is entirely separate from the outside part of the lamp, and is kept cool by the cold blast of air constantly surrounding it. It gives a light of about a six-foot gas burner, and the flame is strong and more free from flicker than gas or the ordinary carbon burner. He also showed, under the microscope, specimens of the gelatine-bromide plates, for photographic work, that had been submitted by a photographer as imperfect. An inspection under the microscope showed three kinds of spots—one caused by dust particles which had settled on the gelatine while still soft, and, as the emulsion hardened, became firmly fixed on the plate; the second kind of spots were caused by (apparently) the solvent action of some substance on the film, as it could be seen to be less dense at those points, while the third were thicker and evidently caused by carelessly spattering the emulsion on partially-dried plates.

The meeting was then declared informal.

Wm. Hoskins,
Secretary.

Buffalo Microscopic Club.—The regular meeting of the Buffalo Microscopic Club was held at the Central School on Tuesday evening, the President, Henry Mills, in the chair.

The Secretary, Dr. Lee H. Smith, read the minutes of the previous meeting, and stated that there had been numerous applications for a printed copy of Dr. J. W. Ward's recent paper upon "Disease Spores." He hoped that they would soon be able to supply this demand, as the paper was one that embodied too much research and valuable information to be lost.

Dr. Lucien Howe read an interesting paper upon the limits of vision with the microscope and telescope. He concluded in brief as follows: "Before leaving the subject it may be worth while to glance back over the course pursued, and observe how it illustrated the methods and results of scientific inquiry. We set out to examine a question free from any considerations which men call practical, and, by doing so, to enter a field where the study of nature pure and simple was the only attraction. That field was a small one, but in it we found difficulties which were large, for here, as elsewhere, the secrets of nature could not be extorted from her without some mental struggle.

"We ascertained at first, by experiment, that the limit of minute vision was an object so small that it would subtend an angle of only seventy seconds. If the object be near by, it would, of course, seem equal in size to one further off, as a dollar held at arm's length covers a space in the heavens the size of the moon. Having determined thus how large an angle must be measured by the smallest visible object, we sought for a reason as to why that limit and no other should be the one which experiment established. This led us to examine a portion of the eye called the retina—a delicate expansion of the optic nerve where the separate fibres, as they come from the brain, terminated in little points known as 'cones.' We found that the area occupied by each of these was, by measurement, about ·004 of a millimetre in diameter; and when an object subtending an angle of seventy seconds was viewed by the eye, its picture on the retina was large enough to touch at least two of these 'cones.' When smaller, it became invisible. The knowledge of this simple fact was apparently not worth half the trouble given to the experiments, nor half the time spent in wrestling with the formulæ in which the results were stated.

"Such study, indeed, seemed worthless until we found that the facts thus established were of no small importance when applied to the use of two familiar instruments—the telescope and the microscope. With one of these we increase widely the range of vision, and by it we are assisted in reckoning time, in calculating the tides, and determining other facts of interest, at least, to the navigator; while with the other we detect impurities in food, we recognize many forms of disease, and in criminal cases we find evidence to condemn the guilty or free the innocent.

"These results are such as relate to money, to health, to comfort, and to other desirable objects in life, readily appreciated by the most thoroughly practical mind.

"Studies which tend, even indirectly, to promote such results are, therefore, not to be ignored, but still more valuable are they to us in adding to our fund of facts and increasing the range of exact science."

The paper was thoroughly discussed by Drs. Ward, Barrett, Prof. Kellicott and others, and in answer to inquiries, Dr. Howe gave several interesting theories of vision and the effects of light upon the retina.

Prof. Kellicott gave a *résumé* of the current microscopical literature. The papers most freely discussed were "Early Detection of Phthisis by Microscopical Examination." "The Use of the Binocular Eye-piece," "Sponges," and "Studies in Pond Life."

American Microscopical Society.—At the annual meeting of the American Microscopical Society of the City of New York, held January 11th, the following-named Board of Officers was elected for the year 1882:

President, John B. Rich, M.D., 12 East Twenty-second street, New York; Vice-President, John Frey, Bellevue Hospital, New York; Secretary, O. G. Mason, Bellevue Hospital, New York; Treasurer, Cornelius Van Brunt, 9 Waverley Place, New York; Curator, George Wale, Paterson, N. J.

Communications and packages for the Society should be plainly addressed to the American Microscopical Society of the City of New York, care of the Secretary, at Bellevue Hospital.

The time of the meetings—8 P.M., the second and fourth Wednesday of the month, at No. 12 East Twenty-second street, New York City.

O. G. Mason, Secretary.

The New Jersey State Microscopical Society.—The regular monthly meeting was held Jan. 16th, at Rutger's College, New Brunswick. The President, Prof. F. C. Van Dyck, read part II. of his paper on Angular Aperture, which is to be completed in a third part. Dr. Lockwood showed specimens of *Bruchus Obsoletus (fabae)* and of beans in which they had been developed, also an interesting slide of eggs laid by the insect Oct. 24th, 1881. He gave succinctly the history of the insect, showing how unusual and premature the oviposition was, as the insect deposits its eggs in spring. The Society intends to give a public soiree in March. Sec.

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EXCHANGES.

A Wales' first-class one-fifth, 170°, wet and dry fronts, adjustable, for a first-class one-half or four-tenths, which must be of wide aperture and adjustable. Allen Y. Moore, M. D., 121 St. Clair St., Cleveland, Ohio.

A villiage cart (used one season: Flandreau maker) for a first-class Binocular microscope. Address "Beardsley," Box 2852 N. Y. P. O.

Very fine stereoptican with eight inch condenser, value $75, for a good microscope suitable for photographic purposes, or would give first-class photographic portraiture. Rockwood, 17 Union Square, New York.

Sole skin and fossil wood (showing fern structure) from Iowa coal, for other good material or mounted objects. John Walker, Minneapolis, Minn.

A Ballard breech-loading rifle, in good condition, for a good spectroscope. D. L. H., Box 58, Kingsville, Ohio.

A small 3 draw telescope, with sun-glass, made by Dolland, London, for a 1-16th objective of moderate angle, by any first-class maker. Dr. Mercer, 37 Twenty-sixth St., Chicago.

Wanted, a small microscope stand or accessories, for an Amer. Optical Co. 8 x 10 double-swing back camera, very suitable for micro-photography. Has been used a few times only. F. F. Stanley, Swampscott, Mass.

Living Volvox Globator, in any quantity, for mounted algæ or other slides. St. Lawrence River or Northern New York algæ; desmids and diatoms for same, in other places. J. M. Adams, Watertown, N. Y.

Birds' eggs and whole insects in exchange for mounted objects of any kind, in good condition and well mounted. W. J. M., Box 201, Moorestown, N. J.

Fine fern-leaf copper crystals, arranged, and named diatoms; fine histological and pathological specimens; sections of teeth—the latter on the ground-glass slides, used at Geological Hall, Albany, N. Y. The above are all nicely mounted, and only first-class slides are required in exchange. Dr. Robt. Dayton, 559 Euclid Ave., Cleveland, O.

THE AMERICAN

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AND

POPULAR SCIENCE.

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Remarks on Uniformity of Nomenclature in Regard to Microscopical Objectives and Oculars.

BY R. H. WARD, M.D.*

THE *nominal focal length* of an achromatic objective, as used by microscopists generally, represents its amplifying power as actually used in the compound microscope. Even the equivalency in amplifying power with a single lens of the same focus is no longer distinctly realized, while the size and appearance of the combination, its working focus, angular aperture, and microscopical efficiency, are not even hinted by the figures used. The nominal focus represents the magnifying power and those properties dependent on it. Like other measurements, these must be stated by comparison with known standards. To use diverse and unknown units of measurement in cases designed to be compared with each other is simply self stultification. To call two lenses, of identical magnifying power, respectively one-fourth and one-sixth inch lenses, is just as indefensible as to call two houses of equal height, forty and fifty feet high respectively. To argue against the existing looseness of usage in naming lenses, is only to state what everybody knows in regard to the advantages of uniform standards of measurement generally. So impressed are many microscopists with the urgency of this question, and so determined are they to escape from some of the present confusion, that a committee has been appointed to report on the subject. Though that committee is unprepared to report, it is believed that giving publicity to some facts and opinions involved in the consideration, may lead to useful agitation and to increased definiteness of ideas and of information in regard to it. Of course it would be premature to claim or expect accuracy of statement or safety of opinion in such a complication of disputed questions; and what is said, is designed to be contributory and suggestive, and in no degree dogmatic or final.

The great variation in objectives of identical name is familiarly known and is undisputed. Among other people one-fourth of an inch is less than four-tenths and more than one-fifth; but among microscopists it may often be more than the first or less than the last. An indefinite number of figures might be published to prove or illustrate this irregularity, the writer having been particularly interested in making and recording these comparisons for more than a dozen years, and Messrs. Bicknell, Biscoe, Higgins, Cross, and many others having been especially interested in the same study; but it is idle to prove what everybody knows and admits. So familiar have some of these apparent errors become by use, and good usage too, that they have been often accepted as established, even one of the latest authorities[*] stating the power of the one-fourth-inch objective five times as high as that of the one-inch.

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*Being the substance of remarks make by the writer at the Indianapolis meeting of the American Association for the Advancement of Science.

In the early days of the compound microscope as a really useful instrument, we find microscopists wishing that microscope makers would "grind their glasses to some settled standard."[†] We are willing to be more reasonable now, or else the conditions stated have become more difficult. We do not desire, nor consider it practicable that the opticians should make all their combinations of certain definite and conveniently graded powers; but we do propose so to name our powers, if we can, that each number shall group together all those powers of which it is the nearest and best description.

Makers would doubtless be considered as doing a favor to those who use their instruments if they would, after finishing lenses, carefully estimate their powers and name them by the fractions most nearly representing those powers. But even if this were done, and much more now when this is certainly not done, or not done upon such a uniform plan as to be satisfactory, microscopists should always re-examine their lenses in order to be definitely informed in regard to one of their most important properties.

The easiest method of examining the *magnifying power* of an objective, by measuring the image (of a known object) which it forms at a standard distance (now ten inches), was as well understood a hundred years ago as now; a lattice of fine silver wire or of human hair, or a scale ruled on glass, being used to measure the image.[‡] A positive ocular[§] or the eye-lens of a negative one is used as a simple microscope with which to read off the measurement. If a separate piece of apparatus were to be made for the purpose of measuring these powers, a positive ocular with micrometer attached would doubtless be preferred, it being placed by means of the drawtube or some other contrivance at such a height that its micrometer should be ten inches from the objective. Its reading would then give the real size of the image formed at that distance by the objective, and the ratio of this number to the known size of the object, say the distance apart of two lines on a stage micrometer, would give the magnifying power of the objective. But as few are possessed of a large variety of apparatus, or care to buy a piece for so infrequent a use as this, the measurement is generally made with an arrangement which every microscope ought to include, a negative ocular with a micrometer in the focus of its eye-lens, whose advantages for general micrometry are so well understood, giving the best view of the object and a sufficiently good view of the measuring lines, that it is usually preferred for that purpose. Of course the field lens is removed in measuring the power of the objective alone,[*] but replaced for ordinary work. If it should be thought best to name lenses by their magnifying power alone, the power ascertained could be at once attached to the lens, the present one-inch lens becoming No. 10, or x10:[†] but if it should be the usage to name it by its power when combined with some standard (say two-inch) ocular, it would be marked No. 50, or x50, or perhaps x45 or x55. Should it be preferred to retain the nomenclature by inches of focal length, a power of ten diameters might be called a one-inch lens, and powers above and below rated in proportion. This plan is within reach of the opportunities of every microscopist, while the plan of actually employing a single lens of small aperture and exactly one-inch focus as a standard of comparison is only adapted to the use of the opticians and is not free from question as to what standard is meant after all. The lens made as a standard is probably not a one-inch lens at all (principal focus), for the principal focus is never used in the microscope; and authorities differ as to whether it should have conjugate foci of one-inch and ten inches, or ten inches apart (one-inch and nine inches). Assuming x10 as a one-inch power, would be most easily applicable and unmistakable; and this power, ten, divided by the ascertained power of any ocular or objective would give the equivalent focal length of that objective or ocular without comparison and beyond dispute.

The chances of error in this case are the same as in ordinary micrometry, with one or two additions, and should in all cases be ascertained in order to test the reliability of any series of observations. They are due to the uncertain value of the divisions of the stage micrometer, to the like (but less important) variability of the measuring scale, to the uncertainty as to the exact optical correspondence of the lines selected for comparison in the two scales, and to the uncertainty as to obtaining exactly the assumed distance between the upper scale and a given point of the objective. The first of these errors is the largest, and its magnitude would surprise many who have noticed and admired the remarkable "perfection" of the common micrometers. A micrometer which ought to be the best in the writer's possession, with lines 100, 1,000 and 2,000 to the inch, has a certain error of ·02 and a limit of error of ·035. This is entirely too much latitude for a single source of error, and of course it is nearly eliminated by comparing a large number of spaces belonging to at least several different scales, rejecting any scales which by differing widely from the average standard are presumably erroneous, and averaging the rest. The remaining sources of error may be similarly reduced by averaging, though their aggregate limit of error, ascertained by comparing the average measurements with extreme figures beyond which there is no possibility of doubt, will be found to be very small and inconsiderable.

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[*] Suffolk, Microscopical Manipulation. London, 1870.

[†] Baker on Microscopes. London. 1742.

[‡] The measurement of the image, formed by the objective only, on a screen at a distance of several feet, as employed by Dr. J. J. Woodward at the Army Medical Museum at Washington, is unquestionably the most reliable method of determining the amplifying power: but is a method which requires too many applications and too much skill to be universally applicable.

[§] The convenience and growing popularity in this country of this continental term suggest the propriety of its general substitution for the awkward name eye-piece.

[*] Dr. J. J. Higgins in the American Naturalist, Dec., 1870, p. 628.

[†] It might be 9 or 11, and thus the various degrees of power would be conveniently expressed.

The standard *distance of measurement* in estimating magnifying powers may be stated to be, at present, ten inches. The distance of five inches has been recommended, even somewhat recently,* and eight,† nine,‡ and ten§ inches have been successively used. The smaller numbers were evidently too small, and the last, ten inches, seems to be permanently accepted as most correct theoretically and most convenient in use. If, however, the metric system were to come into general use, this distance would be changed to two hundred and fifty millimetres with increased convenience and with a scarcely appreciable difference in results. The sooner such a change is made the better, provided it is certain to come at all, and possibly it might be considered only a fair concession to the convenience of the great number of continental microscopists, and to the excellence of their metric system, to make this change without further delay.

The propriety of measuring the image at this standard distance, when estimating the power of objectives or oculars is undisputed, and it would seem equally undisputable that the whole power of the compound microscope should be obtained in the same manner, were it not that the authorities have always differed in regard to the subject. When Hooke, Griffith, Hogg, and other eminent authorities have directed that the image should be measured at the distance of the object on the stage, and Lardner, Carpenter, and Suffolk, in common with most microscopists, measure the image ten inches from the eye wherever the object may be, it is useless to appeal to authorities. It would seem, however, that the former direction, to measure the image at the distance of the object, must be an inadvertency which could lead only to confusion. The writer has fully stated this question in a recent review,* and therefore omits further discussion of it here.

A more difficult question is as to the *point in the objective from which the measurement should be made.* If the objective had an optical centre and we could find it, there would be no difficulty in the case. But the modern objective has no permanent optical centre, at least none that we can easily find and use, and unless some one can give us a better rule, we may be obliged to measure from the bottom of the whole system, or from (about) the centre of the lowest pair or set of lenses. Mr. Charles R. Cross† has proposed to evade this difficulty by measuring ten inches between the conjugate foci used, without regard to the position of the objective; a plan which would be very eligible with high powers, but inconvenient if not inapplicable with low powers, since few compound microscopes have a body short enough to bring the conjugate foci within ten inches of each other with very low objectives, and, if they did, the magnifying power, instead of being that generally used, would be greatly reduced or altogether suppressed.

The very low power objectives (say four and five-inch) are usually mounted short in order to leave sufficient room between them and the stage, and their power as ascertained by an arbitrary rule, would be greater than that at which they are usually worked, unless, in their ordinary use, the draw tube were habitually raised enough to compensate for the shortness of their mounting.

At what point of *screw-collar adjustment* the angular aperture and the magnifying power should be computed, is one of the most complex questions involved in the discussion, and an entirely unsettled one. Most makers state the angular aperture of their lenses at its highest point, but no such uniformity of usage exists in regard to their magnifying powers.

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* Brocklesby, N. Y., 1851.

† Baker, Lond., 1742.

‡ Martin Fokes, Esq., P.R.S., 1742.

§ Lardner, Carpenter, Suffolk, etc.

* The American Naturalist, June, 1871, p. 229.

† Boston. 1870.

With the lenses of a dozen years ago this would be comparatively unimportant, but with many of the high-power and high-angle lenses of the present day, the effect of the screw-collar movement is too great to be disregarded. It has been proposed, and would be most easy, always to rate objectives at their arrangement for uncovered objects, this being a naturally fixed point, and the only one at which the maker's judgment in regard to the accuracy of the correction is usually known; but this usage would greatly underrate many of the high objectives. On the other hand, rating them at their highest adjustment, or at an average between the two, might be vitiated by the fact that the point of highest correction is not a natural and fixed one, but is somewhat dependent on the judgment or caprice of the maker, some lenses of equal power being capable of a much larger range of corrections than others are. And finally, if we could agree upon some standard thickness of glass, and the glass were sufficiently uniform in refracting power, the same standard would scarcely be convenient for all powers (low powers being generally worked by the great majority of microscopists through glass, say 1-100 or 1-125 inch, for which many high powers are incapable of good adjustment), and few microscopists are sufficiently expert in the use of the screw-collar to make the same adjustment from the same glass-cover. Adopting the highest point of adjustment would perhaps involve the least change from present usage; and in cases of unusual interest or importance it might be well to give both extremes, or else to specify the angle and power at which the combination was worked to accomplish the results specified. Attention need hardly be called to the fact that this great increase of power and angle, amounting sometimes to more than one-half of the minimum amount, is due entirely, not to the interposition of the cover-glass or other medium, but to the change in the relations of the lenses caused by the movement of the screw-collar. Where an extra front of different properties is added, we have essentially another objective whose power and angle should doubtless be separately stated.

The use of *linear measurement* in recording and stating powers has become so general that there may now be said to be no respectable deviation from the custom. In the early history of microscopy, powers were generally stated according to the visible flatness or depth of the object, in superficial or cubical measure, and it was plausibly urged that this represented the real, visible enlargement of the natural object; but, aside from the inconvenience of the large and often incomprehensible numbers thus obtained, this method gives in one sense the magnifying power, but in no sense the microscopical power employed. The power to see small things depends, so far as real or apparent size is concerned, on the distance from each other of minute points of structure, and this is in the exact ratio of the linear magnifying power. Squaring or cubing this power has acquired a suspicion of sensationalism, if not of charlatinism, and is generally avoided in science.

If anything could be more confused and confusing than the different real and nominal powers of the objectives, it would be the corresponding powers of the *eye-pieces* or oculars. Made without any pretence of uniformity, and named without any serious attempt at significance, it has seemed until recently that no escape from the confusion was to be looked for. Yet it would seem to be convenient and altogether unobjectionable to have the oculars so named as to express their magnifying power, and the practice of doing this has been already introduced into this country. Some microscopists have re-named their oculars by their magnifying power, on the basis of one-inch to ten diameters, and I am informed by Mr. Bicknell that Tolles has already adopted the same plan, in naming those of his manufacture, discarding the letter nomenclature (A, B, C, etc.) and selecting 2 in., 1⅓ in., 1 in., ⅔ in., ½ in., 4-10 in., and ¼ in., giving powers of 5, 7½, 10, 15, 20, 30, and 40 diameters. The writer has applied the same names to his oculars, applying the intermediate fractions, 8-10 in., ⅓ in., and ⅙ in., to intermediate powers; and he is satisfied, by experience of its convenience, that this nomenclature only needs a trial, to secure its adoption by all who use the microscope for other purposes than amusement. Of course any microscopist, having determined the power of an objective and the powers of the microscope when that objective is used with his various oculars, can obtain the powers of his oculars by dividing the latter numbers by the one first named, and can then name his oculars, like the objectives, either by their magnifying powers or by their equivalent focal lengths. The rivalry of makers and the interests of trade are not involved in this case as in that of the objectives, and there may be no reason why this plan, if as acceptable to microscopists generally, as it has been to a few, should not come into immediate use.

In order to work the objectives and oculars at their standard powers they should be, of course, about ten inches apart either by length of compound body or by use of draw tube; and it is believed that most objectives whose corrections are accurate enough to show any difference will work best at about this distance. Should a decidedly different distance be used in any observations of importance, it would be well to state that fact in recording the observation.

In reviewing this subject, the following *points* would seem to be reasonably well *settled:* Objectives should be, and could be to a much greater extent than they now are, rated according to a uniform standard. They should be named not arbitrarily, but in a manner indicative of their magnifying power. Ten inches is the standard distance of measurement in estimating powers. This distance should be taken from the eye to the rule by which the measurements are made, without regard to the distance of the object on the stage. Magnifying power is always stated in linear measure. The magnifying power and angular aperture, as well as the maker's name, should be engraved on all objectives, and added to all particularly important drawings made by their means. Oculars should be named, like the objectives, in such manner as to indicate their magnifying powers or equivalent focal lengths.

The following are some of the more important *queries* which still remain *open.* Should the standard one-inch objective be characterized by magnifying ten diameters as used in the compound microscope, or should it be compared to a simple lens of actually measured focus or foci? Should the objective be named by its equivalent focal length or by its amplifying power, or both? Should our standard distance of measurement be changed from ten inches (254 millimetres) to nine and five-sixths inches (250 millimetres)? From what point in the objective shall the distance to the scale be measured. At what point of screw-collar adjustment shall the objective be placed for rating its angular aperture and amplifying power? Should the name *ocular* be substituted for "eye-piece" in general use?—*American Naturalist, March,* 1872.

The Siliceous Shelled Bacillariæ or Diatomaceæ.

(Continued from page 40, Vol. V.)

II.—SPECIAL PART.

SYSTEM.

ALL the systematic works hitherto published on the diatoms have one great fault. The main groups in them are based on characters which are sometimes so variable that they can hardly be used for determining the single species. Under this head belongs, for instance, the presence or absence of the Amorphous Slime cover in the Frustulieæ; of the stipes or foot, in the genera, Gomphonema, Podosphenia, Podosira, Tessella; the occurrence as single individuals, or the combination of several individuals in a complex body. All these appearances are more or less changeable, and only in particular cases can they serve as a basis for subdivisions, or genera. Of more importance, however, are the relations of structure presented by the siliceous frustules. These appear so decided, so safe, that they can be recognized not only in all the living, but in the dead and fossil forms, and, for a classification of the diatoms, they give just as exact criteria as does the skeleton for the systematic arrangement of the vertebratæ. These relations of structure, I always made the basis in the minute working, and I used them the more decidedly, as I have found at the same time that the conditions of form and growth of the soft organic parts are closely connected with them.

The different degrees of growth are put together in the following conspectus. We in general distinguish, besides the *status liber* (in which the individuals are not attached, but live free), and the *status affixus* or *adnatus* (in which the individuals are attached, and are furnished with a more or less distinct, longer or shorter, foot):

I. The *Status Singularis.* 1. Solitarius, (the individuals single, and only coupled during the division, Navicula, Tab. III., f. 48).

II. The *Status Congregationis.* (During life the individuals are united in great numbers, and remain so.)

As subdivisions of these, we may notice:

1. The status congr. (*a*) tabellaris, (the individuals are, by their side [neben] sides, united into plates, Tabellaria, Pl. xv., f. 10).

   (*b*) Fasciæformis (the individuals are wholly, by their side sides, united into ribbons, Fragilaria, Pl. xvi., f. 4).

   (*c*) Filiformis (the [round] individuals are, by their whole side sides, united into limb-like threads, Melosira, Pl. II., f. 10, 11).

2. The status congr. concatenatus (the individuals separate themselves after division only at alternate ends, and remain united at the other end by soft, and often very small and scarcely visible, cushions, Diatoma, Pl. xvii).

3. The status congr. flabelliformis (the individuals, after division, separate themselves only at the upper ends, and at the lower remain united in a fan-shaped form, Licmophora, Pl. xii., f. 1—Synedra, Pl. xiv., f. 11).

4. The status congr. radiatus (the individuals, after division, group themselves in a radiate manner, Synedra, Pl. xiv., f. 2 and 7).

III. The *Status Involucratus.* (Many individuals are wrapped in a soft, gelatinous substance, which again appears in different phases of development, according to which we distinguish):

1. The status involucr. amorphous (where the covering substance appears outwardly formless, Frustulia, Syncyclia, Pl. xxii., f. 2).

2. The status involucr. filiformis (when the covering substance presents a thread-like, hard, or rigid tube, or hose, Schizonema, Pl. xxiii., f. 2, 3).

3. The status involucr. frondosus (when the covering substance consists not only of an outward soft tube, but also of inner hard tubes, Micromega, Pl. xxviii., f. 1, 2, 3).

4. The status involucr. foliaceus (when the covering substance forms a leaf-like skin, spread out, Dickieia).

DIATOMEÆ.

(Diatomeæ et Diatomaceæ *Ag.* Naviculacea *Ehrenbg.* Bacillarien and staff animals of Authors.)

Vegetabilia cryptogamica ex regno Algarum, classe Isocarpearum; e cellulis siliceis, vel solitariis, vel (divisione imperfecta) varie conjunctis, nunc liberis, nunc affixis, nunc substantia gelinea inclusis constituta. Fructus: spermatia globosa, solitaria e cellulis siliceis oriunda.

The diatoms form an especial class of the isocarpic algæ, differing decidedly from all others of this group by the silex-covered cells. I put them at the head, as Agardh has already done in his Systema Algarum. The complexer forms are partly parallel with some of the other algæ, but they are usually peculiar.

According as the siliceous frustules are chiefly furnished with only cross striæ, without longitudinal markings, or seldom with cross striæ, but always with longitudinal streaks, or, again, without either cross striæ or longitudinal streaks, but, on the other hand, with peculiar markings or pores, punctate or cellular, the diatoms may be divided into the following general groups: (1) *Striated*, (2) *Vittated*, and (3) *Areolated.* These groups are natural, but it is difficult to find a sharp, complete character for them, to be expressed by one word, and so, perhaps, the chosen terms may be replaced by better ones.

The first group is, at any rate, distinguished from the others only by negative characters; and therefore the term "Striated" does not, nor can it, express a general and positive character; it shall only serve as a trial name for the group. Both the other groups are in the same predicament.

TRIBE I.

STRIATED DIATOMS. (*Gestreifte Diatomeen.*)

Frustule siliceous, either smooth or in side view (latere secundaria) transversely striated, neither vittate nor areolate.

Order I. Astomaticæ; without a central opening in side view (ostiolo medio) median nodule.

Order II. Stomaticæ; with the central opening.

Order I. Astomaticæ; Diatoms without central nodule (Mundlose Diatomeen). Median aperture in the side side (Nebenseiten,) side view, of the quadrilateral frustules obsolete.

* Transverse striæ unbroken (striis perviis).

Family I. Eunotieæ; Frustule prismatic, quadrangular; primary sides curved, lower one concave, upper one convex; secondary sides (side view) flat, with transverse pervious (unbroken) striæ.

Family II. Meridieæ; Frustule prismatic, rectangular; attenuate at the base; primary sides cuneiform, equal and connivent; secondary sides flat, obovate, and transversely pervious striate.

Family III. Fragilarieæ; Frustule prismatic, rectangular; primary sides linear, equal; secondary sides plane, sometimes attenuate, alike, either smooth or transversely striate; striæ pervious.

* * Striæ interrupted at the middle.

Family IV. Melosireæ; Frustule disc formed, cylindrical or globose; primary sides cylindrical; secondary sides flat, or convex, circular, and more or less smooth, or with the margin radiately striate.

Family V. Surirelleæ; Frustule either circular or prismatic; primary sides frequently connivent, secondary, flat (sometimes twisted); striæ marginal radiate, or transverse, interrupted at the middle.

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Aulocodiscus Orientalis.

HAVING recently received from my correspondent, Mr. Christian, a fine slide* of the rare and beautiful diatom *Aulocodiscus Orientalis, Grev.*, I am able to add, for the information of the students of this branch of botany, some features of the histology of the plant which escaped Greville's notice, and so rendered his description incomplete. His figure is yet more deficient than his text. The following is his description, as given in the *Transactions of the Microscopical Society of London*, vol. xii., New Series, 1864, p. 12, pl. 11, Fig. 6:

"*Aulocodiscus Orientalis*, n. sp., Grev.—Disc colored, very convex; processes numerous (7 to 15, or more), cylindrical submarginal; umbilicus circular; structure minutely and distinctly cellulate, the cellules arranged in both radiating and concentric lines, which suddenly pass into moniliform striæ at the margin. Diameter ·0045″ to ·0060″. (Plate II., Fig. 6.)

Hab., Ceylon; Dr. Macrae.

A most charming diatom, delighting the eye with its exquisite symmetry. At first sight it is so like A. Oregonus that one is apt to reject at once its claim to novelty. At the same time, a single really searching glance is sufficient to decide the question. Of A. Oregonus, Mr. Ralfs remarks: 'Under a low power its minute granules appear arranged in waved or oblique lines, but imperfectly radiant under higher powers.' In the present species, on the contrary, the structure is essentially and exquisitely radiant, whatever power may be used. In the description of A. Oregonus, the term granules is appropriately used, as the structure is apparently composed of granules; in A. Orientalis it is impossible to use such a term, as there is not the very slightest appearance of granules, but simply a sort of cancellated cellulate arrangement, with the light coming through the interstices so clearly as to establish its character beyond dispute. The beautiful concentric cellulation is also totally wanting in A. Oregonus. On the other hand, there is a greater resemblance in the numerous processes. In both species they are linear when viewed laterally; but in our new species they are not so apparently 'emarginate' as they have been defined to be in A. Oregonus. When very minutely examined, however, the processes in both are found to be rounded at the apex. The furrows in our present species are extremely narrow, having the appearance of transparent ribs, dilating suddenly into small, blank spaces at the processes."

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*The slide has 21 examples, of different sizes, and numbers of "feet" or submarginal processes, arranged to form the letter G.

This description by Greville is good, so far as it goes, but does not include all the characters of the plant, reverses some, omits others; and the figure by Huth, after Greville's drawing, shows only two of the special characters of the species correctly, viz., the radiating and concentric arrangement of the cellules. The figure purports to be drawn 400 ×; it requires 1,000 × by a first quality modern lens to see the cellules, while 1,500 to 1,600 is better.

The figure represents the cellules as squarish black dots on a white or blank ground, an appearance that cannot be obtained by any focusing. With a medium power, say 250 to 400 ×, with the surface a little beyond the true focus, the effect is brilliant, light, circular dots, on a colored ground, i.e., the cellules act as convex lenses, and condense the transmitted light to a focus.

Description and figure read, "umbilicus circular." The figure represents it perfectly blank and transparent; so it appears under a low power; under 1,000 × it is solid, opaque, colored a bluish green, apparently with an indefinite structure, but which may be only the optical expression of varying thickness of the plate of silex.

The furrows are extremely narrow, so narrow that it sometimes needs close study to determine which are true furrows and which are the approximation of two other radiating rows of cellules. The furrows are bordered by a single row of cellules, like all of the genus, from the umbilicus to the processes, the intermediate space, by exactly the same shaped cells, in contact with each other, bifurcating as they diverge from the umbilicus. The regular radiation of the cellules and their geometrical, concentric, circular arrangement is the most striking feature of the species. The disc is not in any one of my specimens "very" convex, but they vary; all are more or less undulate, so that under medium amplification they present two to four concentric rings of light and shade, as part of the surface is in focus or out, greatly enhancing the beauty of the plant. Dr. G. says, "the furrows have the appearance of transparent ribs." I have invariably found the appearance the reverse! perfectly opaque ribs, like the sticks of an umbrella.

The cellules are the last peculiar character; they are not round, not hexagonal, as in most of the order, not triangular, as in some few, but almost square, in close contact with each other, merely a barely visible line separating them, a feature that I know of in no other diaton. They are brown in color. I have not been able to make out any definite structure in the interior of the cellules. The cellules require a power of 1.000 × to see them, 1,500 × to 1,600 × to see them well.

Hab., Jack's Ranch, about 10 miles from Monterey, Cal.; Mr. Norris.

The study of this diatom shows the importance of the use of modern objectives of higher powers than have been considered essential for histology. Dr. Greville was one of the best and most experienced observers of the diatoms, one of the best describers; *presumably*, he used the best lenses of his day, yet he failed to find many important details, in this instance.

CHARLES STODDER.

Boston, Feb. 5th, 1882.

No Organic Matter in Meteors.

A LOUISVILLE (Ky.) paper reports an interview with Prof. J. Lawrence Smith, of that city, in the course of which Mr. Smith gave reasons for discrediting the reported discovery of organic substances in meteors, as claimed by Prof. Hahn, of Berlin. Mr. Smith said:

"Although I have probably examined more microscopic plates of fragments of meteorites than any other person, still I have never discovered anything like organic remains in any of them. Besides, the well-known chemical composition of these bodies is averse to the existence of any such remains as spoken of by Prof. Hahn. Were these remains present we should discern carbonate of lime on their interior. The two or three that have any carbonate of lime were discovered and analyzed by myself, and in these cases the carbonate of lime was an accidental constituent of incrustation deposited on the surface after their fall. In the microscopic examination of these polished plates of meteorites the two predominating minerals, enstatite and bronzite, will, by their fissures and forms, sometimes remind one of vegetable and other organic forms, but the merest tyro of an observer will trace here nothing but a bare resemblance. And, furthermore, the very igneous nature of these minerals precludes the possibility of organic remains, even in terrestrial minerals of similar kind. Not knowing of any eminent German geologist named Prof. Hahn, I thought it but reasonable and logical that I should inquire something about him from my friend, Prof. Hawes, now in the employ of the Smithsonian Institute, and the best lithological microscopist in this country, and who recently returned to this country after two years' study with Prof. Rosenbaum and others into the microscopic character of rock. In answer to my inquiries, Prof. Hawes wrote me this letter:

"'I read that paper of Prof. Hahn's. He is a kind of half-insane man, whose imagination has run wild with him. These forms which he so accurately describes and figures have long been known to exist in meteorites, and have been frequently described by mineralogists and microscopists. They are mainly composed of enstatite or bronzite in radial forms, and fractured in such a peculiar manner as to give them the appearance of structure. Some of the American meteorites which I have examined show these forms in great beauty, but Prof. Hahn is the only man who has seen anything organic in them, and his paper has excited nothing but ridicule. It reminds one of the long and laborious research of a German professor who found a whole flora and fauna, which he named with double Latin names, and which he found in his microscopic examination of basalt.'

"It is very clear to my mind," continued the professor, "that these cranky observations, viewed with the spectacles of the imagination of Prof. Hahn, have obtained more publicity than they merit."

◆

Microscopic Machinery.—Machines in a watch factory will cut screws with 589 threads to the inch—the finest used in the watch has 250. These threads are invisible to the naked eye, and it takes 144,000 of the screws to weigh a pound. A pound of them is worth six pounds of pure gold. Lay one upon a piece of white paper, and it looks like a tiny steel filing.

The Use of the Microscope in Consumption.—II.

NECROSIS OF LUNG: DIFFERENTIAL DIAGNOSIS.

By Ephraim Cutter, M.D.,

New York. Principal of Med. Dept., American Institute of Micrology.

In a late number of the American Journal of Microscopy I gave some account of the facile diagnosis of the disintegration of the lungs in consumption, with the mode of conducting the examination by means of toothpicks. I took it for granted that no one would mistake the histological elements of the toothpicks for the inelastic fibres of the lungs, and in the list of things found in sputa these were left out. But it has been suggested to impress the importance of the observer's studying the tissue of the wood of the toothpicks, which is readily done by rubbing them together over the slide, scraping together, or with a knife or file; moisten in clean water and cover, and then study. The importance of our studying sources of error in morphological examinations cannot be overestimated, and it is hoped these few words may sufficiently impress the reader.

H, Fig. 1, is a portion of the liber fibre of a toothpick of the ordinary four sided, right-angled, bluntly double-pointed wooden kind. Of course the woody fibre of different toothpicks will vary with the wood of which they are made. It is so easy to make a simple physical exploration and ascertain beforehand the peculiarities of the liber cells, bast fibre, sieve ducts, E, Fig. 1, pitted ducts, and transverse fibres, that one is hardly excusable who mistakes the fibres of the toothpick for the non-elastic fibres of the lungs.

As to the fibrillæ of linen, bast fibres, and cotton fibres, rolled, twisted, macerated, and soaked in the secretion of the air passages, there would be more excuse for mistakes in the absence of a polariscope.

There is, however, an additional point I would like to insist on here more forcibly than in my previous paper, and that is the presence of *Elastic Fibres* in the Sputa of Consumption.

A, Fig. 1, shows these fibres. They are much larger than the inelastic fibres, B, Fig. 1, are more curling, have fissures transversely, sometimes almost cracked in twain; are quite conical, tapering off to a point sometimes, reminding one of coral or glass work. They are not so often found as the *non*-elastic fibres, which were described in paper 1. They show, of course, that the lung is breaking down, and when the morphology of the blood and the clinical history points to consumption, their presence is pathognomonic.

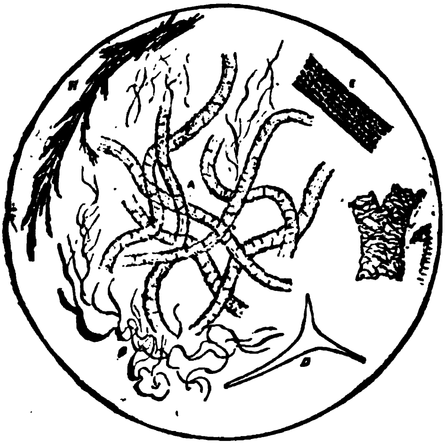

Fig. 1.—A, Elastic lung fibres; B, inelastic do.; C, lumen of vessel (probably blood); D, trifid vegetable hair, or sponge spicule; E, sieve duct from toothpick; H, liber fibres, do., do.; about 500 x.

Sometimes they occur in detached portions, small fragments that look like pieces of rough glass shivered up.

Another point:—Sometimes is found the whole lumen (C, Fig. 1) of a bloodvessel with branches and sub-branches skeletonized like skeletonized leaves. These are most beautifully and clearly dissected from the deeper portion of the lungs. Indeed, where a whole lung lobe is necrosed and broken down by the vinegar yeast of consumption, one would expect to find all of the connective vessels and frame work dissected out. There is a great variety of the forms presented by the elastic and non-elastic fibres of the lungs in the sputa of consumptives, which it would be very profitable and instructive to figure out here, but as the material is sadly so abundant it will be much better for the reader to study them from nature and not rely on drawings; and if this writing does anything to stimulate workers in this direction, I shall be glad. D, Fig. 1, is a curious body I have never before met with in sputa. I am inclined to think it is a vegetable hair accidentally present. Dr. Salisbury suggests it may be a rare spicule of sponge swallowed in drinking water, as it was homogeneous, solid, lustrous, like an ordinary sponge spicule.

Are there any cases where elastic fibres are found in the sputa of patients other than consumptive?

Yes. Such a case has been under my observation lately, in which I was somewhat at a loss to account for the occasional presence of elastic and non-elastic lung fibres, and yet which I deem to be non-tuberculous. Mr. N——, Swede, printer of engravings, 55 years old, short, stout, chest large, muscles well developed, formerly considered a giant in strength while a seafaring man, consulted me for severe hæmorrhages of the lungs, cough, irritation of throat and nose. flabbiness of muscles, weakness, etc. A careful physical exploration of the case revealed the signs of an hypertrophied heart approaching, if not, fatty degeneration; ulceration on right side of vomer—post pharyngeal wall, small tumour on epiglottis tip; some crepitant râles, not very distinct, over both lungs, but no marked signs of lung necrosis.

The blood had the morphology of syphilitic blood, but not the morphology of consumptive blood, etc.

The case was carefully watched, and the sputa studied at least twice a week for several months. On three separate occasions elastic and non-elastic fibres were found. Of course, deeming these as positive evidence of lung necrosis, and the patient supposing he was in consumption because of the hæmorrhages of the lung, it became a matter of considerable importance to us both that there should be no mistake made in the matter. Under treatment the hæmorrhages have well nigh disappeared, the heart improved, and about all his complaint is of his throat, which is caused by the little wart on the epiglottis, which the laryngoscope reveals.

I have been led, in the entire absence of the morphology of consumptive blood under the microscope, to refer the primary cause of the bleeding to the hypertrophic heart, causing an alteration in the circulation of the blood in the lungs. The too forcible stroke of the heart driving the blood produces a hyperæmia and rupture of a bloodvessel. The next thing is the inhalation of the blood into the air passages of the opposite lung (Thompson), often filling the lumen of the air sacs, packing the areolar tissues, clotting, undergoing erosion, softening, necrosis, and the formation of cavities, with cough and sputa containing the tissue elements of the lung just as we have them in consumptive sputa.

This is not the place to go at length into this subject, and I would refer the interested to the work of Dr. Thompson, which is a most valuable contribution to our knowledge of hæmorrhages of the lungs, but which without the use of the microscope would be divested of much of its positive evidence. On p. 126, lines 17 and 18, our distinguished author says: "I do not pretend to distinguish in all cases between the non-tubercular form of ulceration and the continuation of a tubercular form."

In our experience reliance is placed on the microscopic evidence found in the blood, called the morphology of consumptive blood, to differentiate in such cases, as in the instance alluded to in this paper (Salisbury). This fact always makes the microscope an instrument of precision, and not a toy, for the physician who means to be well up in physical exploration.

The following is the full title of Dr. Thompson's work: The Causes and Results of Pulmonary Hæmorrhage, with Remarks on Treatment. Reginald E. Thompson, M.D. Cantab., Fellow of the Royal College of Physicians; Senior Assistant Physician and Pathologist to the Hospital for Consumption and Diseases of the Chest, Brompton. With illustrations. London: Smith, Elder & Co.

March. 1882.

Value of Swinging Sub-Stages.

CONSIDERABLE difference of opinion exists on this point, and the following is a statement of both sides of the question.

Mr. Grubb, in introducing his form of swinging sub-stage to the Royal Irish Academy in 1853,* very clearly foresaw the advantage it would produce for oblique illumination. He dwelt particularly on "the power of directing the illuminating beam on the object at all angles of incidence . . . , and of registering the position at which peculiar effects are obtained." With Mr. Grubb's microscope, however, the varying effects of obliquity of the illumination were obtained only by continued readjustment of the reflecting prism; the observer could not conveniently watch the effect of the changes in obliquity whilst actually making them—as with the Thury-Nachet traversing sub-stage, which we regard as a very perfect realization of the advantages to be obtained by gradations of oblique illumination. The principle in this latter is indeed so good, that we hope to see it applied on a larger sector-carriage, so that greater range of motion may be allowed for the condenser. For use with our most recent homogeneous-immersion objectives, the motion in arc of M. Nachet's condenser is too limited to develop the fullest power of their apertures. The only reason we can assign for the neglect with which Mr. Grubb's sector and M. Nachet's traversing sub-stage were received by microscopists in general, is that in those early days so few objectives were produced with apertures large enough to be used effectively in conjunction with such apparatus.

The intention of all the swinging arrangements—both those above referred to and the others described at pp. 1060–80 of vol. iii.—is to provide oblique illumination up to the highest limit of transmitting power of aperture possessed by our objectives; also to provide "dark field" illumination beyond this limit, or opaque illumination above the horizon of the object under examination, together with exact means of registering the inclination of the light, etc., so that the effects may be repeated again with certainty.

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* Proc. R. Irish Acad., v. (1853) pp. 296-7.

It has, however, been objected to the swinging sub-stage that it is an unnecessary incumbrance, as there are various condensers which convert axial into obliquely incident light up to the utmost practical limits of obliquity. Of those recently constructed with special reference to "immersion" illumination, we may note the Abbe-Zeiss oil-immersion condenser, Powell & Lealand's two forms, and Stephenson's catoptric immersion illuminator. In all these devices diaphragms are arranged to exclude a portion of the centre of the pencil, and to allow more or less of the peripheral zone to be utilized, the range of action being still further increased by the eccentric and rotating motions of the sub-stage in which they are used.

There can be no doubt that to a very large extent these condensers give effects of oblique illumination equal to those obtained with the swinging sub-stage; but it must be remembered that the latter enables us to regulate the precise *angle and amount* of light that is most effectual with every variety of objects. No disposition of diaphragms has yet been applied to condensers used in the axial sub-stage to enable us to regulate the *amount* of light without altering the *obliquity*. In this respect, therefore, we think the swinging sub stage is an advantageous addition to the microscope. A further advantage is the facility with which, by its means, the *mirror* or a low-power condenser may be used above the stage for the illumination of opaque objects.

Many experiments conducted with a view to the determination of the most efficient means for obtaining oblique illumination have led us to value the plan suggested by Mr. Bulloch, of Chicago, as shown in Fig. 141 on p. 1078, vol. iii. (1880). Placing the microscope horizontally, with the lamp attached to the concentric swinging sub-stage, a hemispherical lens in immersion contact with the base of the fluid-mounted slide, and using as a sub-stage condenser a 2-inch objective with the lower half of the front lens covered up, we have been able to obtain with a minimum expenditure of time some of the most satisfactory images by oblique light that we have yet seen.

It may not be superfluous to remark that the most modern developments of high-power microscopy tend more and more to the prolonged and exhaustive examination and study of individual specimens under every variety of effects of light. Here again it must be acknowledged that the swinging sub-stage proves of service by the rapidity with which the changes of illumination can be effected, and the certainty with which they can be recorded and repeated.

We do not here attempt to decide which special system of construction is most effectual. The question whether the radial arc originally devised by Grubb embodies the principle in the most practical form, is open to discussion, and this applies equally to the Thury-Nachet device, the Zentmayer swinging arm, or Tolles' traverse-lens.

Some discussion took place at the June meeting of the Society upon the preceding note, in which Mr. Crouch, Mr. Stephenson, and others took part.

Mr. Crouch said that in the early part of the year 1876 the swinging sub-stage was re-introduced by an American firm of opticians, and exhibited at the Centennial Exhibition held in Philadelphia in that year as an improvement upon the various forms then in use. "As it was almost immediately adopted in this country, and has since, with some slight modifications, been applied by various makers, both here and in America, it has occurred to me that the time has arrived at which it is possible to ascertain what the advantages offered are (if any), and whether they are of sufficient importance to necessitate the remodelling of those stands usually fitted with the substage. At any rate, I think the discussion of this subject can only tend to the elucidation of facts which are of importance in the construction of the modern microscope-stand.

"The sub-stage, it need scarcely be stated, is an addition made to the microscope for the more ready application of the illuminating accessories applied beneath the object practically comprising the polariscope, various dark-ground illuminators, and the achromatic and other condensers, either dry or on the immersion system. For the two first-named methods it is not suggested that a swinging substage is of any advantage. For immersion condensers, also, it cannot be of use, and its application is therefore limited to dry condensers of presumably small angle and comparatively long focus. Now, as the result of my own experience, and also that of all those whom I have had the privilege of consulting, this is found to be the most unsatisfactory and uncertain of all methods of obtaining an oblique illuminating pencil.

"It will at once be conceded that the proportion of objects for which this method of illumination is useful is exceedingly small, consisting mainly of a few of the diatomaceous tests, the resolution of the striation of which requires objectives of great aperture and high power. The immense majority of objects, however, shown by transmitted light require the use of objectives of lower aperture and power, ready means of applying the various accessories, and a firm stage with or without mechanical adjustments, giving a considerable range of motion.

"Now, since the introduction of the swinging sub-stage, what do we find to be the tendency of the alterations either made or suggested? In the case of microscopes provided with mechanical adjustments to the stage, a perilous attempt to reduce the thickness of the necessary plates and a serious limiting of the traversing movements with an increased complication of parts, which I can only look upon as a step backwards. For many years past the alterations made in the stand have all tended to a simplifying of construction and a consequent increase of strength, with less chance of derangement of the adjustments, and I cannot help thinking that we ought to be chary of making an addition which leads in the opposite direction, and which, as experience shows, only gives a result which can be better and more readily obtained by other means.

"I have only to add that I, with many others, shall be pleased to learn authoritatively whether anything has been done with the aid of this addition that has not been better done without it. I have the pleasure of the acquaintance of many possessors of microscopes fitted with this adjunct, and as yet, with one exception, my inquiries have met with an answer unfavorable to it, the latest reply being that the owner had found it so inconvenient that he had made a fixture of it."

Mr. Stephenson said he concurred generally in the views expressed by Mr. Crouch.

It must always be borne in mind—and this was a matter of fact and not a matter of opinion—that objectives having apertures exceeding the equivalent of 180° in air could only be fully utilized by some immersion appliance (condenser or otherwise), and it was essential that this should give an aperture at least as great as that of the objective employed. A lens, or prism, must in every such case be attached to the slide by some immersion fluid of a refractive index equal to or exceeding the numerical aperture of the objective. Of course the swinging sub-stage might support an independent condensing lens throwing light on the lens or prism attached to the slide, making an arrangement similar to the traverse lens of Tolles, which was much simpler; but, as the full aperture of every objective could be utilized without a swinging sub-stage, he preferred the ordinary rigid form, which was better adapted for axial illumination.—*Jour. Royal Mic. Soc.*

False Appearances Produced by Hardening.

DR. G. H. SAVAGE, of Bethlem Hospital, writes:—

It is of the utmost importance that, in drawing conclusions from hardened specimens we should know what changes may be produced by the reagents used for preserving. As I am in some doubt as to the changes produced by spirit on nervous tissues, I write to ask the aid of brother microscopists as to the changes they have found in spirit-hardened specimens. I am more especially interested in the changes produced in nervous tissues by spirit, and I should be glad to hear from others their experience on the matter, not alone in human tissues, but in those of the lower animals.

My present belief is, that if nervous tissues are placed at once in spirit they will sooner or later show the presence of bodies which do not stain with carmine or logwood, and which, in some cases, do stain with osmic acid. These bodies are not all alike; some have a very suspicious foreign appearance, but others are so like some degenerations that they have been described as such. Some are of irregular rounded outline of varying size; some do take staining in a faint way, and some have a semi-crystalline look which confirms one's idea that they are not antemortem, but the result of the process of preparation. What I should specially like to know is if others have met them in similar conditions. Spitka, of America, described such bodies, and I have heard—but have not the references—that certain German writers recognize them as artificial.

In describing my experiences, I would say that they appear in nervous tissues when these have been in spirit for not less than two months, and that they are more common in the white matter, at all events at first; the more crystalline bodies, in my experience, do not occur till later. I believe that some of the non-staining bodies are due to a breaking up of the white matter of Schwann. Again, I believe that if the specimens are placed in spirit without being finely divided before hardening, they are more liable to produce these bodies. I shall be happy to provide any one with specimens if they will further investigate the matter.—*Jour. Royal Mic. Soc.*

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The Dissemination of Trichinæ.

WE quote the following from the *Journal of Comparative Medicine:* "An investigation, which seems to show that Southern hogs do not have trichinæ, was made by Dr. Jansen T. Payne last summer. His report was submitted to the American Public Health Association at its last meeting. In six months Dr. Payne examined 5,400 hogs, finding only 22 infected with the parasite in question.

The infected animals were reported as having been received from the following places: St. Louis, 18; Louisville, 2; and from the West, marked "unknown," 2; making a total of infected hogs, 22.

Of the hogs examined, only 529 came from St. Louis; most of them came from Louisiana (2,473) and Tennessee (1,060).

The observations lead to the belief, therefore, that Southern-bred hogs are free from trichinæ. Still, such a deduction is not absolutely safe. If the fact were really proved, it would be one of great advantage to Southern pork-raisers. Even as it is, they can profit from the fact that Tennessee and Louisiana hogs are almost entirely free from disease.

Incidentally, some other facts regarding the origin and communicability of trichinosis were developed. Observations seemed to show that hogs infect each other when enclosed in the same pen, and do not depend upon the rat as an intermediate host. The parasite is passed out of an infected animal along with undigested food, and the food is then eaten by a sound hog, who in turn becomes infected.

By Dr. Payne's examinations it was also ascertained that all the hogs infected with trichinæ were corn-fed animals. No mast-fed animals was found to be infected."

The statement that an animal may be infected by eating the fæces of an other animal that has *recently* eaten trichinous food is well known, but this will not in any way account for that dangerous condition of infection which is found in offal-fed and rat-eating hogs. A hog will in this way pick up a few trichinæ, but its flesh does not become dangerous under such circumstances. The number of trichinæ which a pig or a human being may ingest with apparent impunity is something astonishing, and it is only when the flesh of an animal has been thoroughly infected by eating flesh containing a large number of encysted parasites that its flesh becomes dangerous. So far as our present knowledge goes, young trichinæ do not propagate their species until after they have been encysted. The process of multiplication has been fully described in our pamphlet on the subject.

After all that has been written upon the subject we feel fully convinced that the rat is the great disseminator of trichinæ. The fact that corn-fed hogs were the only ones found by Dr. Payne to be infected, sustains this position to a considerable extent. The corn on which the hogs were fed would to a certainty be infested with rats, while these rodents are not usually found in oak woods.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Optical Slits.

Ed. Am. Jour. Microscopy—In the October number of your journal, p. 200, is an article on the "Effects of Optical Slits," by M. Treve; and another in the November number, p. 219, by F. C. Van Dyck, on the same subject. These gentlemen are unable to account for the phenomena thus produced. It seems to me, Mr. Editor, very simple and easily demonstrated. In regular astigmatism of the eye we know that those lines are seen most distinctly which lie in the meridian of erroneous refraction, and those most indistinctly which lie in the meridian of normal refraction. This is due, as is well known, to the fact that in looking at lines it matters not how much their images overlap longitudinally, if they are correctly focussed in their lateral measurements, they appear distinct. So with the slit: A too narrow slit cuts off the rays so as to reduce the angle entering the eye below that degree necessary to distinct vision; and hence all objects seen through the narrow way of the slit are blurred and dim, and if the slit is sufficiently narrow they "may be made to disappear;" while through the long measurement of the slit sharp images are formed on the retina. Now, as in the astigmatic eye, so with a vertical slit, one would expect to see most distinctly horizontal lines, and with a horizontal slit, vertical lines. This any one can easily demonstrate to his own satisfaction by a few minutes' study with a stenopaic apparatus, a cylindrical lens and diagram.

As, to the effect on landscape scenery, etc., mentioned by M. Treve, that is explicable by the fact of most objects on the earth's surface, such as trees, pailings of fences, persons, etc., having their longest measurement vertically, and hence are seen best, as he says, through a horizontal slit. T. E. MURRELL, M.D.

Little Rock, Ark., March 3, 1882.

A New Objective.

Ed. Am. Jour. Microscopy—I received one of Gundlach's objectives recently, which works so well that I would like to say a few words concerning it.

This objective is a ⅛, homogeneous immersion, having an angular aperture in balsam of 140°, and, with this large aperture, a working distance of 1-50 *of an inch!*

The performance of this superb lens on Moller's test plate is remarkably fine—easily resolving every diatom upon it by lamplight and without prism or lens below the object. By central light from the mirror it resolves *Pleurosigma fasciola* (No. 15) in balsam. It gives a fine image of the Podura scale, and, in fact, of all other tests with which I have used it.

But it is not upon test objects alone that it does so well. Upon histological preparations it works beautifully. A fine stained injection of cat's stomach, by Cole, which is a more than ordinarily beautiful section, is shown in great clearness and brilliancy by this objective. Each cell, with its nucleus, stands out clear and distinct without that muddy appearance so commonly seen with the narrow-angled lenses. On a fine differential staining of clematis, by Mr. Fergus, the ⅛ works as well—and shows its superiority over medium-angle glasses—as upon the tests.

But we are told that it is one thing to examine a lot of diatoms or carefully prepared histological slides, and decidedly another to use the same objective for ordinary routine work. Undoubtedly this is true, but the result may be the same in both cases, nevertheless. With this new ⅛ it is so, and I find that in ordinary work (the examination of malignant growths, etc.) it shows its superior qualities in a way that no other objective, with which I am acquainted, can equal. On this kind of work (not permanently mounted) the ⅛ is far superior to a 1-10 of lower angle, but otherwise of the same quality. Still the 1-10 is a very fine objective, and, which is of especial value on histological work, it has a working distance of 1-32 of an inch!

ALLEN Y. MOORE, M.D.

Homœopathic Hospital College, Cleveland, Ohio,
December 14, 1881.

Our Book Table.

Practical Microscopy. By George E. Davis, F.R.M.S., F.I.C., F.C.S. Illustrated with 257 Woodcuts and a Colored Frontispiece. Price, $3.00. For sale by Industrial Publication Co., 14 Dey street, New York.

This work has just been issued in London, and forms a handsome small 8vo. of 335 pages. The author states that his "object in presenting this work to the student of microscopy is to supply, at a reasonable cost, a book written upon somewhat similar lines to Quekett's 'Practical Treatise on the Use of the Microscope,' the second and last edition of which appeared in 1852." Unfortunately for the author's accuracy of statement, the second edition of Quekett's work was not the last. The third, with considerable improvements, appeared in 1855. It is evident, therefore, that Mr. Davis has not made a very careful study of his proposed model. This, however, is a matter of trifling consequence, as it would hardly be worth while at this day to follow Quekett's work closely as a model.

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◆

Larvæ Developed Under Skin of Human Body.—Dr. Bachelor, of Gaboon, recently sent to one of our Medical Societies the larva of a fly which had been hatched under the human skin. In his letter Dr. Bachelor states that a trader had a painful swelling upon one of his hands, which he poulticed with flaxseed meal, and soon discovered a small hole between the middle and ring fingers, from which a peculiar looking worm came, and a second one followed on the next day. At first it was thought that the worms were from the flaxseed meal, but doubt in that direction was dispelled by the fact that another workman had a swelling upon the leg from which precisely the same kind of a worm was extracted. No one had seen the animal prior to this year. Subsequently it was learned that this worm preys upon the gorilla, and that the Panwees, a tribe that follows the catching of these animals and selling them to the traders, are very commonly troubled with these worms, which are probably the larva of some species of fly. One of the specimens sent by Dr. Bachelor was about one-fourth of an inch long, one-eight of an inch thick, and the other was about twice that size.

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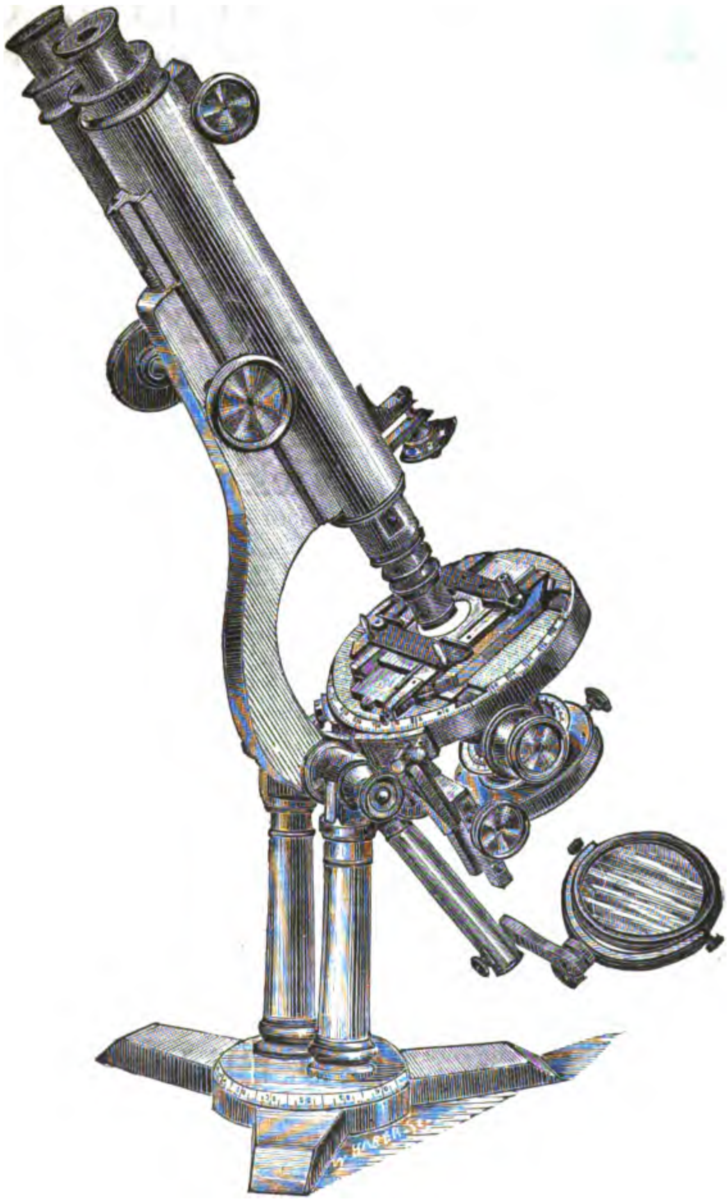

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Amateur Mechanics.—Directions for making designs and working drawings, and for working with lathes, carpenter's tools, scroll saws, etc.; and for soldering, cementing, varnishing, polishing, etc., special attention being given to new methods and processes, where these are found to be real improvements. The various operations mentioned will be applied to the production of special articles of practical utility.

New Books.—New scientific and practical books will be duly noticed, so that those who desire complete and recent information on any subject may know where to get it.

Correspondence.—In this department we intend to place our readers in communication with each other, and in this way we hope to secure for every one just such aid as may be required for any special work on hand.

Exchanges.—An exchange column, like that which has been such a marked success in the *Journal of Microscopy*, will be opened in the Young Scientist. Yearly subscribers who may wish to *exchange* tools, apparatus, books, or the products of their skill, can state what they have to offer and what they want, *without charge*. Buying and selling must, of course, be carried on in the advertising columns.

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On the succeeding page we give a list of the prominent articles which have appeared in the first nine numbers of the Young Scientist.

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Illustrated articles are marked *.

January.—Makeshift Apparatus—Its Successes and Failures; General Rules to be Observed in Using Cements; College Workshops; Our Aims; Aiding the Swindlers; Liquefaction of Oxygen; *The Art of Sharpening Edge Tools; *Penny Microscopes; *A New Slide for Microscopic Objects; Self-Lighting Lamps; Home-made Telephone; Lead in Paraffin Oil; Poisoned by Cheap Jewelry; Silk-Worms at Large; Literature vs. Gymnastics; Long-lived Errors; Iron Bird Shot; Non-Conductors for High Temperatures; the Paris Exhibitior; Plaster of Paris; Parasites on Canaries; A Good Mucilage; Brass Lacquering; Ink that will not Freeze; Magnifying Power.

February.—Beauty and Strength; *Crossing the Atlantic in a Twenty-foot Boat; *Simple Lessons in the Art of Photography; *Simple Legerdemain; The Toad and its Habits; Concerning Ourselves; A Good Watch for a Dollar; Will it Show the Animalcules in Water? The Art of Sharpening Edge Tools—Scissors; Mechanical Genius; *Cheap Stage Forceps for Microscopes; How to Measure the Magnifying Power of Microscopes and Telescopes; Characteristics of Various Woods.

March.—*How to Read a Drawing; A Good Education; *Wood Turning Tools; What is a Diatom? Our Journal and its Influence; A New Postal Law for the Discouragement of Science; What will the Weather be To-morrow? *Making Glass Apparatus; *A Ten-Cent Galvanic Battery; A Shower of Fire; What Power Shall we Use? Paste Eels; Plants Growing Under the Microscope; A Sanguinary Hoax; Finishing Microscopic Slides; Mechanical Work for Girls; Counterfeit Fossils.

April.—A Simple Musical Instrument; *How to Read a Drawing; *Simple Lessons in the Art of Photography; The Trial Trip; The Right to Make Patented Articles; Miss Heller's Second Sight; *The Development of Frog Spawn; Simple Hints for Beginners in Microscopy; Trichina; How to Solder; *Entomologist's Pliers; Tempering Small Steel Tools; Our Ten-Cent Battery; Iron Shot; Are Snakes Beneficial?

May.—*The Champion Kite, and How it was Made; *A Good Ten-Dollar Boat; Our Summer Numbers; Our Prizes; A Word to the Girls; *A Cheap Condensing Lens for Microscopes; A Fifteen-Cent Battery.

June —*How to Study Entomology; *The Champion Kite, and How it was Made; *A Good Ten-Dollar Boat; Our Trial Trip; The Study of Natural History; Something out of Nothing; *Mounting Board for Entomologists; Aquaria; A House Fired by a Milk Can; Lichen Ornaments; What Will the Weather Be?

July.—*How to Begin the Study of Botany; How to Study Entomology; Simple Lessons in the Art of Photography; How to Study Science; How to Make an Aquarium of Microscopic Objects; The Hydra; The Aquarium; Contributions for the Young Scientist; Fourth of July Pistols; New Photographic Process for Copying Drawings; *How to Make a Drawing Board that will not Warp; Veneering; Clothes-Moths, and How to Get Rid of Them; A Large Musical Box; Cementing Labels to Metal; Stand for Cut Flowers; Cure for Burns; Another House Fired by a Milk Can; Case Hardening; An Instructive Experiment.

August.—How to Make an Herbarium; How to Study Entomology; *An Interesting Experiment; *The Archer-Fish; To Prevent Day Dreaming; Canada Balsam Microscopes; Paste Eels; *A New Form of Stage Forceps; Articles in Preparation; Crystallization; How to Make an Æolian Harp; Hints on Filing; Iridescent Glass; Indelible Indian Ink; Hatching Alligator Eggs.

September.—*How to Make Indian Canoes; How to Make an Herbarium; Simple Lessons in the Art of Photography; *A New Form of Frog Plate; *A Collecting Microscope; Pond Hunting; Rules for Using Glue; A Story of Science; A Liberal Offer; Hints on Filing; Mucilage.

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"Contains the best possible reading for the young of both sexes."—[Ottawa Journal.

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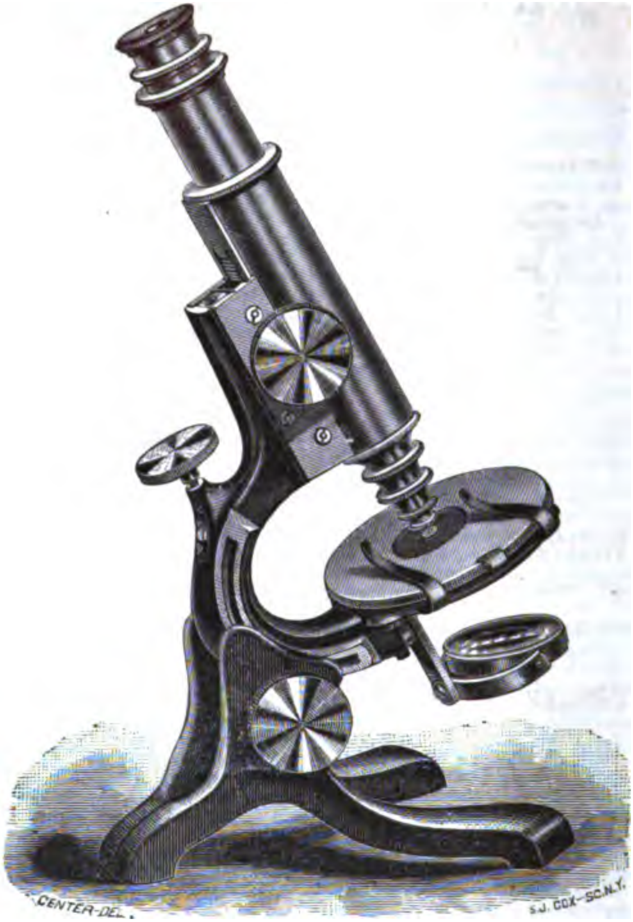
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JULY.—*How to Begin the Study of Botany; How to Study Entomology; Simple Lessons in the Art of Photography; How to Study Science; How to Make an Aquarium of Microscopic Objects; The Hydra; The Aquarium; Contributions for the Young Scientist; Fourth of July Pistols; New Photographic Process for Copying Drawings; *How to Make a Drawing Board that will not Warp; Veneering; Clothes-Moths, and How to Get Rid of Them; A Large Musical Box; Cementing Labels to Metal; Stand for Cut Flowers; Cure for Burns; Another House Fired by a Milk Can; Case Hardening; An Instructive Experiment.

AUGUST.—How to Make an Herbarium; How to Study Entomology; *An Interesting Experiment; *The Archer-Fish; To Prevent Day Dreaming; Canada Balsam Microscopes; Paste Eels; *A New Form of Stage Forceps; Articles in Preparation; Crystallization; How to Make an Æolian Harp; Hints on Filing; Iridescent Glass; Indelible Indian Ink; Hatching Alligator Eggs.

SEPTEMBER.—*How to Make Indian Canoes; How to Make an Herbarium; Simple Lessons in the Art of Photography; *A New Form of Frog Plate; *A Collecting Microscope; Pond Hunting; Rules for Using Glue; A Story of Science; A Liberal Offer; Hints on Filing; Mucilage.

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WHAT WE HAVE DONE.

The following is a list of the most important articles that have appeared in the Young Scientist during the past nine months:

Illustrated articles are marked *.

January.—Makeshift Apparatus—Its Successes and Failures; General Rules to be Observed in Using Cements; College Workshops; Our Aims; Aiding the Swindlers; Liquefaction of Oxygen; *The Art of Sharpening Edge Tools; *Penny Microscopes; *A New Slide for Microscopic Objects; Self-Lighting Lamps; Home-made Telephone; Lead in Paraffin Oil; Poisoned by Cheap Jewelry; Silk-Worms at Large; Literature vs. Gymnastics; Long-lived Errors; Iron Bird Shot; Non-Conductors for High Temperatures; the Paris Exhibitior; Plaster of Paris; Parasites on Canaries; A Good Mucilage; Brass Lacquering; Ink that will not Freeze; Magnifying Power.

February.—Beauty and Strength; *Crossing the Atlantic in a Twenty-foot Boat; *Simple Lessons in the Art of Photography; *Simple Legerdemain; The Toad and its Habits; Concerning Ourselves; A Good Watch for a Dollar; Will it Show the Animalcules in Water? The Art of Sharpening Edge Tools—Scissors; Mechanical Genius; *Cheap Stage Forceps for Microscopes; How to Measure the Magnifying Power of Microscopes and Telescopes; Characteristics of Various Woods.

March.—*How to Read a Drawing; A Good Education; *Wood Turning Tools; What is a Diatom? Our Journal and its Influence; A New Postal Law for the Discouragement of Science; What will the Weather be To-morrow? *Making Glass Apparatus; *A Ten-Cent Galvanic Battery; A Shower of Fire; What Power Shall we Use? Paste Eels; Plants Growing Under the Microscope; A Sanguinary Hoax; Finishing Microscopic Slides; Mechanical Work for Girls; Counterfeit Fossils.

April.—A Simple Musical Instrument; *How to Read a Drawing; *Simple Lessons in the Art of Photography; The Trial Trip; The Right to Make Patented Articles; Miss Heller's Second Sight; *The Development of Frog Spawn; Simple Hints for Beginners in Microscopy; Trichina; How to Solder; *Entomologist's Pliers; Tempering Small Steel Tools; Our Ten-Cent Battery; Iron Shot; Are Snakes Beneficial?

May.—*The Champion Kite, and How it was Made; *A Good Ten-Dollar Boat; Our Summer Numbers; Our Prizes; A Word to the Girls; *A Cheap Condensing Lens for Microscopes; A Fifteen-Cent Battery.

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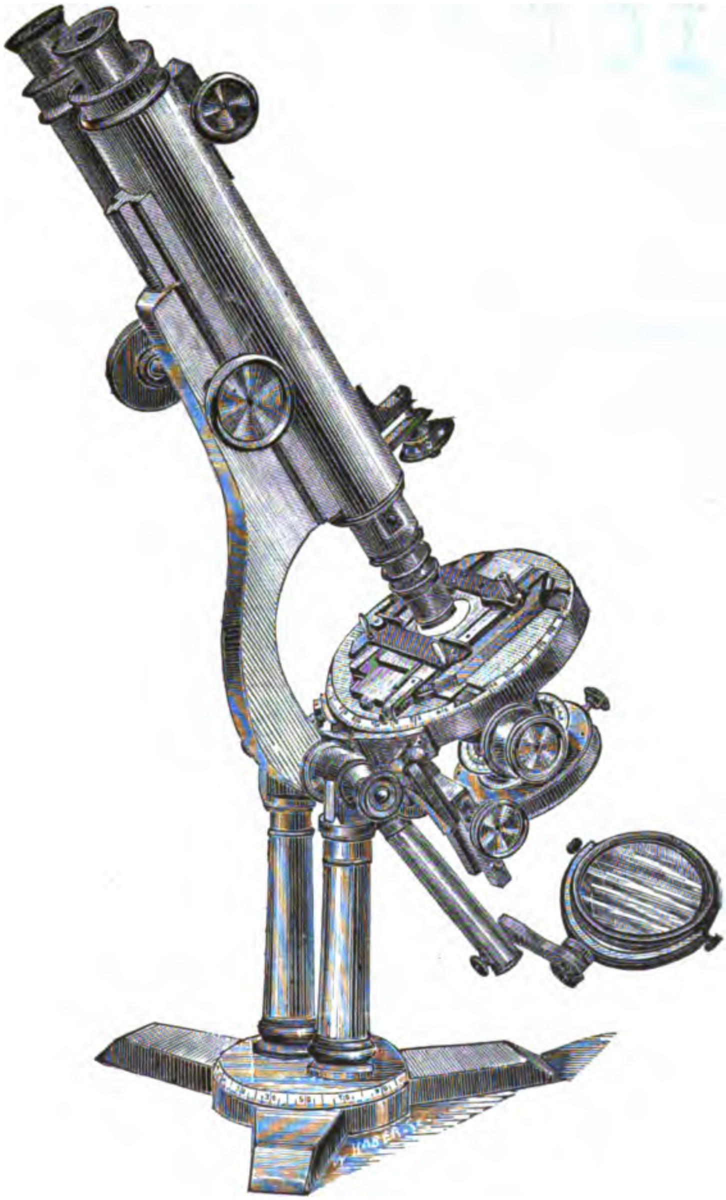

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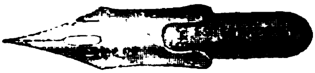

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